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ABSTRACT

A study examined the technological literacy needs of persons trained at community colleges, current labor market trends in the state of Washington, and possible resource-sharing models for use within the Washington State Community College system. Data were collected from 25 mail questionnaires, phone interviews with personnel from 114 companies throughout Washington, and site visits to 10 companies located in Spokane. Companies using advanced technology expressed the need for community college-trained personnel with data/information-, people-, and equipment-related competencies. Occupational growth in Washington is expected to be modest through 1990, with demand centering mainly in the service industries (particularly marketing and sales, office/clerical occupations, and culinary/hospitality services): The State's community college system currently has as least five traditional programs in which supply exceeds demand by more than 300 percent. Three resource-sharing models calling for equipment sharing, equipment and facility exchange, and college consortia were suggested as possibly being feasible in Washington's community college system. (Appendixes to this report include a list of project goals, a copy of the overview of occupation clusters, the pilot and a copy of the mailed survey instrument, copies of the project's mailed survey instrument and personal visitation form, and personal visitation data.) (MN)

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FINAL REPORT

Project No. 85-AXJ(040)NB

CHANGE AND THE FUTURE OF VOCATIONAL EDUCATION

Research Project in Vocational Education
Conducted Under
Public Law 94-482

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February, 1986

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FINAL REPORT

Project No. 85-AXJ(040)NB

CHANGE AND THE FUTURE OF VOCATIONAL EDUCATION

A research report on technological literacy requirements for employment in occupations using advanced technology and the future of employment for graduates of vocational programs in Washington State community colleges.

Research Project in Vocational Education
Conducted Under Public Law 94-482

The project reported herein was performed pursuant to a grant from the Research Coordinating Unit of Washington State Commission for Vocational Education. All materials developed through this contract must comply with non-discrimination and sex equity policies. Contractors undertaking such projects under the Commission for Vocational Education sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Commission for Vocational Education position or policy.

Washington State Vocational Director's Council

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Abstract

The purpose of the research project was to: 1) determine technological literacy needs for community college trained persons working in advanced technology companies; 2) analyze the relationship between current labor market supply/demand trends and numbers of community graduates from corresponding programs available for employment; 3) analyze resource sharing models for utilization within the Washington State Community College system. The project consisted of a descriptive survey of manufacturing and advanced technology companies in Washington State, an analysis of occupational clusters in which supply and demand had been projected, and an analysis of three resource sharing models.

The study defined technological literacy as preparation with communication, problem solving, and quantitative skills necessary to carry out job functions in technologically advanced work environments. The data suggested that the technological literacy skills most critical for community college graduates were data information-type skills of synthesizing, computing and copying; people-oriented skills of negotiating, instructing, supervising, persuading, initiating work, writing, speaking, listening and participating on a team; equipment-related skills of analyzing/identifying problems, creating flow charts, analyzing/solving problems, creating programs, operating equipment, and maintaining equipment. Keyboarding and data entry skills were considered basic requirements for working in technologically advanced environments.

Employment growth in Washington state was projected to be modest through the 1990's. Community colleges were preparing adequate levels of manpower for most of the top twenty demand occupations, but were continuing to graduate numbers of individuals in occupations in which supply is far exceeding demand.

Capital equipment and human resource sharing was seen as a feasible method of reducing the high cost of training, especially in programs utilizing advanced technology.

CHANGE AND THE FUTURE OF VOCATIONAL EDUCATION

Introduction

Technological developments in business and industry are advancing at an almost exponential rate. The kinds of jobs which will emerge from the advanced technology will require utilization of a totally different work force. Technological "literacy" will become a requirement for work. It is apparent that community colleges must adapt to these realities and direct program development and training activities toward goals which will assure that students are prepared to enter present and future job markets with relevant job skills.

The vocational directors council of the Washington State Community College system has been observing and discussing the impact of change upon vocational education in Washington State community colleges for over four years. Other than sporadic innovative program offerings, system-wide change has been slow in response to new technology and changing socio-economic conditions shaping the work environment. The council came to the conclusion that there are adequate data available to community colleges on future trends in technology. Secondly, labor market projections provide fairly reliable evidence of where employees will be needed through the end of the twentieth century. What was now needed was a thorough analysis of these changes to determine the direction vocational education in Washington State community colleges should take to assure that: 1) program offerings

realistically prepare individuals for successful employment in the new work environment; 2) community college vocational education programs continue to be viewed by business and industry as a viable training resource for employees; 3) community colleges secure alternative means to finance programs using advanced technology, as traditional budget resources become more and more limited.

This project addressed these needs by focusing on three areas of study: 1) Technological literacy needs of employees within occupations using advanced technology; 2) Relationship of current program offerings to projected occupational growth and demand for employees; 3) Program and capital resource networking among Washington State community colleges.

The objectives of the project were as follows: 1) To identify correlation between current vocational program offerings and projected occupational demand through analysis of labor market trends; 2) To conduct a descriptive study of technological literacy need for employment in selected occupations in Washington State using advanced technology; 3) To conduct analysis of program and capital equipment and facilities networking models to determine feasibility in the Washington State community college system.

The report of the research project is divided into five sections: **Section** I presents a review of literature and establishes a working definition of technological literacy. **Section** II presents the results of the survey of businesses and

industries using advanced technologies to determine technological literacy needs of entry-level employees. **Section III** analyzes the relationship of numbers of current Washington State community colleges vocational program graduates and projected occupational supply and demand in selected occupations in Washington State. **Section IV** analyzes current resource networking among Washington State community colleges. **Section V** presents implications for decision making and recommendations for future directions for vocational education in the state.

SECTION I

REVIEW OF THE LITERATURE

> **The transition we are involved in has been variously described as a shift to a post-industrial society, an information society, and a knowledge-intensive society.** Jana Matthews and Rolf Norgaard, 1984

Washington State community colleges, through their vocational programs, serve a significant percentage of the potential student population at the technician level. Students and industry expect training which is relevant, up-to-date, and responsive to occupational needs. Students stand to lose access to education which is affordable and essential to their preparation for work if the community college system is unable to respond quickly and effectively to technological change.

> **There are many converging forces of unprecedented significance that promise to alter the configurations of our future society, including the nature of work and the occupational structure. The search for signals about the future is all the more important because of the unsettled and unsettling events of our time. If anything is clear, it is that the future will not take care of itself. Nor will the future involve simply more of the same. The future will test to its very core the adaptive capacity of the United States economy, and the pivotal issue in that context will be the vocational flexibility and adaptability of its work force.** National Center, 1983

From this quotation, it is apparent that many external phenomena impact the future of vocational education. The review of literature was conducted to examine several variables:

technological trends affecting occupations; employment and vocational education; social and economic changes which will help to define the future world of work; and areas of future employment supply and demand. These variables are important to the decision-making process colleges must initiate to develop vocational programs which are relevant, current, and viable.

Social, Political, and Economic Changes

Disturbances and shifts in political regimes and in the balance of power between capitalistic, socialistic, and third-world nations will increase and involve the United States more significantly. American workers will find themselves competing with foreign labor forces as more firms move major production enterprises to foreign countries to save on labor and/or materials cost. International trade, on the other hand, will require a broader worldwide knowledge of other cultures and languages on the part of American workers.

Working hours (work weeks) will be shorter but more intense. The information age will require ability to learn and process new information more quickly and to adapt to rapid and abrupt change. There will be a higher level of tension and work-related stress among employees.

By the year 2000, minorities will be in the majority in more than 50 American cities (American Council on Education, 1984). This will affect local and national policy making and political machines, as minorities campaign for a greater share of the political and economic power regime.

The traditional adversarial relationship between management and labor is evolving into patterns characterized by consensus. Union membership will probably continue to decline. There will be more collaborative efforts between labor and management.

The decline in the fertility rate will result in a decrease in the number of young workers through the 1990s. The proportion of 16- to 24 year-olds in the labor force will decrease by the 1990s. According to the congressional Joint Economic Commission:

1. One-third of the population will be between 25 and 44, with the median age at 33 years.
2. Over one-half of the new entry into the labor force will be women.
3. Twenty percent of the work force will be black or Hispanic.

Technological Trends Affecting Employment and Education

Ninety percent of all new jobs during the period 1969-76 were service occupations. By 1990, 72 percent of the labor force will be in a service-producing industry. While high-technology occupations will continue to increase, the number of positions will not increase. The vast majority of new job openings will be in traditional service-oriented occupations, i.e., janitorial, health, and secretarial.

The advance of new technology and its influence in all areas of business and industry will require higher levels of literacy for all segments of the work force. In fact, it is possible that

"technological" literacy may be required of all members of the work force in spite of the level of complexity involved in their jobs.

The nature of employment will change: fewer employees for higher production; and automation of work which will require more "mental dexterity" than direct physical involvement. This means greater skill in problem solving, conceptualization, verbal communication, and attentiveness to a task. Technology will further create conditions under which frequent career change, continuous retraining, and a knowledge base which will transfer to other work situations will become requisites for survival in the work place.

There is, and will continue to be, more emphasis on small enterprise. Sixty million of the nation's 100 million workers are now in small business. There has been a rapid rise in the annual rate of new business corporations.

While many jobs will be "low-tech" or "non-tech," the nonskilled or nonliterate individual will become displaced as good basic skills (mathematics, written and verbal communication, critical thinking, and problem solving) become entry-level conditions of employment. As a result, the displacement of workers is and will be a national problem. In fact, unemployment may be a way of life for more people during their lifetimes.

Vocational education will have to respond creatively to the following:

1. The need for long-range educational planning rather

than crisis intervention highly specific to an isolated need or incident.

2. The need to improve funding of curriculum change, design and implementation.
3. The need for teachers to be highly qualified and well trained to survive in technology areas.
4. Telecommunication systems will decrease the need for formal stationary classroom training, thus decreasing the need for the traditional instructor.
5. Private businesses will compete with formal schools in providing initial training and retraining, as more and more organizations are doing their own training.
6. The need for cooperative work experience education and the need to link education, business, industry, labor, and government in a cooperative training network is rising as costs for education and equipment escalate.

By the year 2000, there will be a shortage of entry-level workers and an upward crush in middle management. Coupled with this is the trend toward lower salary ranges, with a wider disparity between line staff and management. It is further predicted that the shift from a broad salary range to low or high incomes will eliminte the "middle class" in American economy. Education will have to redefine criteria for selecting certain occupations for training programs based more on skill requirement and need in industry than on salary. It may be that career changes will tend to involve lateral moves rather than vertical

moves on the career ladder.

Areas of Future Employment

New occupations or occupations with substantially changed job content will emerge in careers in: information industries, automated office industries, robotics, space-related industry, health industry, energy industry, and entrepreneurships.

The overall projected change in employment in Washington State in all occupations between 1983 and 1988 is 15.19 percent (Washington State Employment Security Department, 1984). Net job growth in Washington in 1986 alone is expected to be only 38,000 new positions. Those occupational areas with the largest projected overall growth in employment are: engineering, nursing, computer specialists, managers, general clerical workers, construction workers (carpenters and electricians), electronics, and metal-working crafts (excluding machining).

Currently, and in the short run, Washington State, like the nation, is experiencing significant occupational growth in only a few narrow sectors, e.g., hotel and restaurant service, medical technology, office maintenance, and various high-tech-related occupations. In general, these occupations provide lower wages, or demand fewer specialized skills, and/or require little training.

Demand for high-tech jobs in the Washington State area through 1990 will be generated primarily through turnover rather than new openings. This trend should be watched closely.

> **While there is little meaningful evidence on either side of the job destruction question, there is no question that skill requirements are changing rapidly. A readily predictable consequence has been serious labor market dislocations; these seem bound to intensify.**
> Office of Technology Assessment, 1983, p. 17

Washington is already a leader in the well-established high-technology field of aerospace. It also has clear strenghts in the emerging field of health technology and some notable successes in a number of other fields such as software. But beyond aerospace, health technology, and micro-computer software, Washington has yet to establish recognized leadership in high technology. (Battelle Institute, January, 1984, page 3)

> **The key to the future is to gear students to accept and relish a movement to new kinds of work at all times. The great opportunity for education is to prepare men and women for all seasons of their lives.**
> VOCED, Jan/Feb, 1982, page 29

Technological Literacy

When the term "technological" literacy is used, several dimensions of a common definition emerge. The Northwest Regional Laboratory defined technological literacy as preparation to perform in an environment which is dominated by technologically advanced equipment and systems (N.W. Regional Labs, 1983). In discusing the employee in office environments, the definition refers to posession of skills and a knowledge base which enables the individual to function productively in an automated office using tools of computer and telecommunications technology (N.W. Regional Labs, June, 1984).

Battelle defines technological literacy in terms of needs for preparation of students with a strong science and mathematics base at the secondary and postsecondary levels. Battelle also places emphasis on quality of preparation. For instance, math and science curricula need to focus on improving skills in critical thinking, logic, and problem solving, and on application skills.

> **The primary goal should not necessarily be preparing more advanced and esoteric materials, but more thought-provoking materials . . . The orientation of the traditional science curricula should include more than rote memorization of abstract theories. Indeed, they might emphasize the scientific process of investigation . . . .**
> Battelle, 1984, page 240

Hunter and Aiken present a definition of computer literacy which encompasses technology as a whole. They state:

> **Computer literacy may be defined as the ability to use computers and associated information technologies in ways which enhance one's productivity, creativity, and ability to solve problems and communicate effectively with others.**
> Hunter and Aiken, December, 1984

Richard Hersh presents perhaps the most concise definition of technological literacy. He concludes that several composite factors must be present when identifying technological literacy, including a strong mathematics and science base, good communiation skills, a positive attitude toward learning, a spirit of inquiry, and skill in adapting to change and the need to process information quickly.

Hersh points out that the application of knowledge and skill

to new or untried situations is as, if not more, important than the acquisition of that skill.

> **But it is not enough merely to understand quantum mechanics or to know how to get information from a computer. One must also know how to use this knowledge.**
> School Research Forum, May 1983, Page 60

Thus, Hersh asserts that technological literacy means that the individual has a necessary core of abilities which enables him/her to engage in complex thinking, or, "the possession of an appropriate fund of knowledge and the skills to adapt to a continuously changing information base." (ibid)

The National Center for Research on Vocational Education listed competencies needed in working in environments which utilize or produce technology. These competencies were: 1) group problem solving; 2) interpersonal skills; 3) group process skills; 4) problem solving skills; 5) decision making; 6) planning; 7) communication; 8) thinking (reasoning). (The National Center for Research and Development, January 1984, page 23).

For the purposes of the study, an extrapolation on the various dimensions of technological literacy was done to arrive at a definition which seemed appropriate for the research task. Technological literacy was defined as preparation with communication, problem solving and quantitative skills necessary to carry out job functions in technologically advanced work environments. The competencies which technologically literate individuals would then demonstrate were identified as: 1) able to

write clearly and verbally communicate ideas, information, or processes to others; 2) able to exercise judgment and critically analyze new or different problem situations to arrive at a solution; 3) able to process new information; 4) able to apply learned skills or acquired knowledge to new situations which require altered or different responses; 5) able to participate in group processes as a member, with flexiility as may be required for individual or group tasks; 6) possession of basic science and mathematics knowledge to carry out assigned technical tasks.

This working definition of technological literacy was then used as a basis for skills identified in the descriptive study report in section II.

SECTION II

DESCRIPTIVE SURVEY REPORT

> **For the foreseeable future, changing technology will be a fact of life in all workplaces. Learning to use new machines and new kinds of machines will be a part of every job. Even more significantly, learning new ways of organizing and managing information will be a continuing process for everyone.**
> (Beverly Hunter and Robert Aiken, 1984, p. 27)

Introduction

This section presents findings obtained from a survey conducted by the Center for Research and Professional Development at Gonzaga University from March 1, 1985 through December 1, 1985. The survey portion of this research project focused on objective #2 of the research project: To conduct a descriptive study of technological literacy needs for employment in selected occupations in Washington State using advanced technology.

The Center for Research and Professional Development at Gonzaga University sought to accomplish nine objectives via the survey:

To Identify:

1. occupational titles in the advanced technology fields for which an entry-level, associate degreed applicant would qualify;
2. data/information related competencies required to work productively for each occupational title;
3. people related competencies required to work productively for each occupational title;
4. equipment related competencies required to work productively for each occupational title;
5. core competencies related to data/information, people, and equipment that are generic to all advanced

technological fields;

6. technological equipment used for each occupational title;

7. technological changes in equipment organizations envision will take place in the next five (5) years.

8. additional skills required by these technological changes; and

9. the extent to which businesses, using advanced technology, are interested in forming a link with education in providing work experience for students.

Survey Methodolgy

This section of the report includes a description of: the population of companies to which results can be generalized; procedures used to collect data; and instrumentation used for data collection.

Description of the Population

The ad hoc committee on Change and The Future of Vocational Education identified the population for the survey. The population consisted of companies listed in the Advanced Technology in Washington State: 1984 Industry Directory. A total of 451 companies are listed in this directory and all were mailed a survey.

In addition to this population, the Center chose to survey a sample of manufacturing companies in Washington for a comparative data base. A total of 200 companies that grossed at least one million dollars and had at least 51 employees were selected from the Washington State Manufacturers Directory. The manufacturing companies were not mailed a survey; rather, they were asked to participate in a phone interview survey.

Data Collection Procedures

The Center's proposal indicated that data would be collected through a mailed survey and through a personal visitation to selected companies. Data were collected via the personal visitations; however, due to a low response rate using the mailed survey, a phone interview also was used to collect data required to accomplish the nine objectives of the survey study. Following is a complete description of how data were collected and problems incurred during this process.

A survey was mailed to all 451 companies listed in the Advanced Technology in Washington State: 1984 Industry Directory during the second week in June. Returns were requested by July 15, 1985. The surveys were addressed to the principal officer listed in the directory. Unfortunately, after this initial mailing only eight of the 451 companies returned a completed survey. In an attempt to increase the return rate, each company that had not returned a survey was contacted by phone to determine if the survey had been received and if the company was willing to complete and return it. All companies indicating they did not recall receiving the survey were mailed a second copy of the survey.

The phone contacts provided some interesting findings. Three companies were duplicates--which brought the total number of companies down to 448. Of the companies called, only 276 could be reached (49 companies either had phones that were disconnected, or did not answer their phone). Twenty-five

companies indicated they were not interested in the study and 45 companies said the survey did not apply to them. Interestingly, of these 45 companies, 37 had less than 51 employees. The remaining 206 companies indicated they were interested in completing the survey.

The phone contacts seemed to indicate that most companies that hired associate degreed persons were willing to complete the survey; however, the return rate following the phone contacts only increased the response rate to 25 companies. This rate was not acceptable as it would not provide a valid data base. Consequently, the Center determined that another method for collecting the data needed to be employed. This method entailed a phone interview.

Because a low percent of small companies (having employees numbering less than 51) indicated they hired associate degreed persons, the Center decided to limit the phone interview to only those companies that had at least 51 employees, had indicated they had hired associate degreed persons, and had expressed a willingness to respond to the mailed survey. The total number of companies to be contacted for the phone interview was 114. These 114 companies did not include 10 companies located in Spokane, as the Center planned to contact these companies for a personal visitation. These 114 companies combined with the 25 returned mailed surveys brought the total number of companies in the sample of advanced technological companies of 139. For each interview, the director of personnel was contacted and provided the information needed.

In addition to these 139 advanced technological companies, attempts were made to contact 200 manufacturing companies. The same phone interview format was used for the manufacturing companies as was used for the advanced technological companies. Although this population was not selected by the contractor, the Center thought the manufacturing companies could serve as a basis for comparing data obtained from the advanced technological companies.

Another data collection procedure involved personal visitations to selected advanced technological companies. The personal visitations were to provide more specific information regarding competencies needed for employees to successfully function in jobs requiring an associate degree. A personal visitation was made to ten companies (six in Spokane and four in Seattle). In each company, the director of personnel was interviewed.

Description of the Instruments

Three instruments were developed for the purpose of this study. One instrument was the mailed survey, a second was the phone interview form, and the third was the personal visitation interview form. Following is a description of each instrument.

1. Mailed Survey:

The mailed survey asked the respondents to identify three occupational titles in their company that required an associate degree. If there were more than three such titles, the respondent was to name the three which had the largest number of employees. For each occupational title named, the respondent was asked to identify the extent to which several job competencies were considered important in order for an employee to perform effectively in his/her initial job assignment. A five-point Likert scale was used for this rating.

The job competencies were divided into three categories: Data/information; People; and Equipment. These three categories were used based on categories presented in the Dictionary of Occupational Titles (1978). The job competencies originally listed in this dictionary were modified somewhat, to better fit the potential skills required of a person working with advanced technological equipment. The major changes in job competencies listed were those included under the Equipment category. This category was named "Things" in the dictionary and most of the competencies listed under "Things" involved working with animals or objects not associated with advanced technological equipment. The job competencies included on the survey for each job category are listed below:

Data/Information	People	Equipment
Synthesize	Negotiate	System Analyze
Coordinate	Instruct	Programme/set-up
Analyze	Supervise	Control for Quality
Compile	Persuade	Control
Compute	Initiate	Operate
Copy	Write	Diagnostic Repair
	Speak	Maintenance Repair
	Serve	Monitor
	Follow instructions	
	Participate on a team	

A definition of each competency included on the survey was

provided on a sheet enclosed with the survey. Finally, the respondent was asked to identify the types of advanced technological equipment used for each occupational title he/she had identified on the survey.

The survey was reviewed by the contractor. Suggested changes were incorporated into the instrument and it was then pilot tested. The Center distributed the draft survey instrument to three (3) personnel directors in the advanced technological field. All three directors were located in Spokane. A personal interview was scheduled with each. The purpose of the pilot test was to determine if the personnel directors felt the instrument was clearly stated and was comprehensive. The personnel directors also were asked if they felt the survey would be completed and returned, given the nature of the survey and the time required to complete it. One personnel director actually completed the survey and the time required to complete it was approximately 15 minutes. Based on the pilot testing, suggested changes were incorporated into the instrument. Appendix C describes the pilot test procedures used and Appendix D includes a copy of the mailed survey instrument.

2. Phone Interview Survey:

The phone interview survey was designed to elicit the same type of information as the mailed survey; however, the phone survey was shortened in order to increase the response rate. One change made on the phone interview, compared to the mailed survey, was the elimination of the five-point Likert scale for the various job competencies. A "yes" or "no" response format was used instead. Another change made in the phone interview survey was the combination of job competencies that had similar definitions. And a third change was the incorporation of the definitions into the description of the job competencies--in order to eliminate the need to define terms over the phone. Following are the job competencies included on the phone interview survey:

Data/Information	People	Equipment
Synthesize/interpret	Negotiate	System Analyze
Compile	Instruct	Identify Problems
Compute	Supervise	Identify Solutions to Problems
Copy	Persuade	Programme
	Initiate	Operate
	Write	Maintain equipment
	Speak	
	Listen	
	Participate on a team	

Appendix E includes a copy of the phone interview form.

3. Personal Visitation Survey

The personal visitation survey was comprised of questions that were similar to the questions asked on the phone interview survey. However, the personal visitation survey questions were posed in a more open-ended fashion, allowing the respondent to provide descriptive information about job skills needed for positions that required associate degrees within the company. Appendix F contains a copy of the Personal Visitation Interview Form.

RESULTS

The results are presented for each of the nine survey objectives. Data presented for the advanced technological companies represent responses obtained from the phone interview as well as the mailed surveys. The 25 mailed surveys were recoded to match the phone interview form. Prior to presenting the results for the nine objectives, a description of the respondents is provided. Although 100% response rate was not obtained, the response rate was high and the advanced technological companies do seem to represent the disribution of companies included in the Advanced Technology in Washington State: 1984 Industry Directory. The percent of responses obtained from the manufacturing companies also was quite high, thereby increasing the ability to generalize the results to manufacturing companies of similar size and profit

level.

Description of the Respondents

A total of 106 advanced technological companies responded to either the mailed or phone survey. This represents a 76% response rate. A 64% response rate was obtained for the manufacturing companies (n=129).

The products and services represented by the advanced technological and manufacturing companies are presented in Table 1.

Table 1: A description of the Products and Services for the Advanced Tech and Manufacturing Companies

Advanced Technolog Co. Products and Services	No.	Manufacturing Co. Products and Services	No.
Electronic components	27	Food products	21
Computers	27	Newspapers	9
Instrumentation	26	Machinery/instruments	36
Program/software	15	Household supplies	21
Communication equipment	17	lumber/paper	21
Research & Development	25	Clothing	4
Data Processing	13	Chemicals/fuels	15
Miscellaneous	4	Other	3
Bio-technolgy	5	Other	2
Semi-conductors	4		

The number and percent of advanced technological and manufacturing company respondents that fell into various size categories are presented in Table 2.

Table 2: The Number and Percent of Companies in Various Size Categories

Size Category	Advanced Tech. Co. (N = 106)		Manufacturing Co. (N = 129)	
	Number	Percent	Number	Percent
< 51	11	10%	0	0%
51-100	51	49%	52	40%
101-250	26	25%	48	37%
251-500	8	8%	19	15%
500 +	10	9%	10	8%

The number and percent of advanced technological and manufacturing companies that fall into various types of companies are presented in Table 3.

Table 3: Number and Percent of Companies That Fall Into Various Types of Companies

Type of Co.	Adv. Tech.Co.		Manufact. Co.	
	Number	Percent*	Number	Percent*
Sales	29	27%	1	.8%
Service	40	38%	0	0%
Manufacturing	50	47%	129	100%

* The percent total does not equal 100% as some companies belonged to more than one category type

Of the 106 advanced technological companies responding to the survey, 64 (64%) indicated they had occupations within their company that required an Associate Degree. Only 13 of the 129 manufacturing companies (10%) said they had positions within their companies that required an Associate Degree.

Of the 64 advanced technological companies that hired Associate Degreed persons, 61 (95%) of such employees use some form of advanced technological equipment. Similarly, 12 of the 13 manufacturing companies (92%) that hired Associate Degreed persons indicated that these persons use some form of advanced technological equipment.

Results for Objective 1: Identify occupational titles in the advanced technological fields for which an entry-level, Associate Degreed applicant would qualify

The occupational titles that emerged from the data fell into nine categories. The number of occupations mentioned for the advanced technological and manufacturing companies are presented in

Table 4.

Table 4: A Description of the Occupational Titles

Job Title	Advanced Tech Co. (N = 132 positions)		Manufacturing Co. (N = 18 positions)	
	Number	Percent	Number	Percent
Office positions (clerical, book keeping, office management)	21	16%	8	44%
Production Manager, Assembler	4	3%	0	0%
Computer or equipment operator	7	5%	0	0%
Programmer/system analyst	5	4%	3	17%
Software aide/tape librarian	2	1%	0	0%
Engineer/mechanical or electrical technician	75	57%	5	28%
Control analyst	6	4%	1	6%
Drafter/illustrator	7	5%	1	6%
Laboratory assistant or technician	5	4%	0	0%

The vast majority of job titles (57%) mentioned by personnel directors of the advanced technological companies related to engineer or technician. The job title mentioned most often by manufacturing companies related to office type positions (44%) and to engineering or technician (28%).

Results for Objective 2: Identify data/information related competencies required to work productively for each occupational

title

Four data/information skills were included on the phone interview survey:

a. Synthesize or integrate data/information for the purpose of making decisions about the job;

b. Compile, gather, collate or classify data/information;

c. Perform data analysis--compute mathematic operations and report outcomes.

d. Copy, transcribe and/or enter data/information so it can be analyzed.

The data/information related skills for each occupational title are presented in Table 5. Data/information skills are used frequently in the high technological companies. The vast majority of job positions mentioned under six of the nine occupational titles requires the use of all data/information skills. In rank order, relative to the frequency of which data/information skills are used in job positions, the occupational titles are as follows: Drafter; Computer Programmer, Control Analyst; Lab Technician; Engineer/Technician; Office Positions. The jobs for which data/information skills don't seeem to be in high demand are: Production Management; Software Aide/Tape Librarian; and Computer and Equipment Operator.

The manufacturing companies had job positions that related to only five of the nine occupational titles. Office Positions; Programmer; Engineer/Technician; Control Analyst; and Drafter. The data/information skills that are frequently used for job positions within each of these five occupational categories of the manufacturing companies are similar to skills required in high technological companies--with the exception of the Engineer/Technician occupational title. For this title, very few data/information skills seem to be required. Another comparison that is interesting to note relates to the Computer Programmer occupational title. Although synthesize, compile, and compute

Table 5: Results Obtained for Data/Information Skills

Occupational Title	Co. Type	Data/Information Skills			
		Synthesize	Compile	Compute	Copy
Office	H.Tech	15(71%)	19(90%)	13(62%)	15(71%)
	Manuf.	6(75%)	7(87%)	4(50%)	7(87%)
Production Manager	H.Tech	1(25%)	1(25%)	2(50%)	1(25%)
	Manuf.	0	0	0	0
Equipment Operator	H.Tech	3(43%)	4(57%)	4(57%)	2(29%)
	Manuf.	0	0	0	0
Programmer	H.Tech	4(80%)	5(100%)	5100%)	4(80%)
	Manuf	3(100%)	3(100%)	1(20%)	1(20%)
Engineer/ Technician	H.Tech	57(76%)	62(83%)	54(72%)	56(76%)
	Manuf.	1(20%)	2(40%)	1(20%)	1(20%)
Control Analyst	H.Tech	6(100%)	5(83%)	4(67%)	6(100%)
	Manuf.	1(100%)	1(100%)	1(100%)	1(100%)
Drafter	H.Tech	7(100%)	7(100%)	7(100%)	7(100%)
	Manuf.	1(100%)	1(100%)	1(100%)	1(100%)
Software Aide/ Librarian	H.Tech	1(50%)	1(50%)	1(50%)	0
	Manuf.	0	0	0	0
Lab Technician	H.Tech	3(60%)	4(80%)	5(100%)	4(80%)
	Manuf.	0	0	0	0

skills are similar to both high technological and manufacturing companies, few job positions within this occupational title for the manufacturing companies required the skill of copying and computing data (compared to 80% of the job positions related to Computer Programmer within the high technological companies that required this skill). Appendix G contains a more specific description of data/information competencies required in companies included in the personal visitations.

Results for Objective 3: Identify people skills related competencies required to work productively for each occupational title

A total of nine people skills were included on the phone interview survey:

a. Negotiate or exchange ideas, information, and opinions with others in a decision making process;

b. Instruct or teach others about some aspect of the job;

c. Supervise other workers;

d. Persuade or influence others in favor of a product, service, or point of view;

e. Initiate work projects (i.e. be an independent worker);

f. Write or exchange information in writing;

g. Speak or talk with others to convey or change information;

h. Listen to and follow directions given by others; and

i. Participate on a team--work with others for the purpose of problem solving.

The number and percent of job positions that use these nine people related skills are for the various occupational titles are presented in Table 6. Overall, the results indicate that people related skills for high technological companies are most important for Control Analysts, Office Positions, Drafter, Engineer/Technician, Computer Programmer and Computer/Equipment Operator. People skills are not as important for a Production

Table 6: Results Obtained for People Related Skills for High Tech and Manufacturing Companies

Job Title	Type	People Related Skills								
		Negotiate	Instruct	Supervise	Persuade	Initiate	Write	Speak	Listen	Work on Team
Office	Hi.Tech	16(76%)	14(67%)	9(43%)	15(71%)	16(76%)	18(86%)	21(100%)	21(100%)	20(95%)
	Manuf.	5(62%)	4(50%)	2(25%)	2(25%)	3(37%)	4(50)	8(100%)	8(100%)	5(62%)
Product Manager	Hi.Tech	1(25%)	1(25%)	2(50%)	2(50%)	3(75%)	1(25%)	2(50%)	4(100%)	4(100%)
	Manuf.	0	0	0	0	0	0	0	0	0
Equipment Operator	Hi.Tech	4(57%)	4(57%)	2(29%)	4(57%)	5(71%)	5(71%)	6(86%)	7(100%)	7(100%)
	Manuf.	0	0	0	0	0	0	0	0	0
Computer Programmer	Hi.Tech	5(100%)	3(60%)	1(20%)	1(20)	5(100%)	4(80%)	5(100%)	5(100%)	5(100%)
	Manuf.	3(100%)	3(100%)	1(33%)	0(0%)	3(100%)	1(33%)	3(100%)	3(100%)	3(100%)
Engineer/ Technician	Hi.Tech	60(80%)	49(65%)	33(44%)	41(55%)	47(63%)	65(87%)	75(100%)	75(100%)	68(91%)
	Manuf.	2(40%)	1(20%)	0(0%)	1(20%)	0(0%)	1(20%)	5(100%)	5(100%)	1(20%)
Control Analyst	Hi.Tech	6(100%)	5(83%)	2(33%)	4(67%)	4(67%)	5(83%)	6(100%)	6(100%)	6(100%)
	Manuf.	1(100%)	0(0%)	0(0%)	0(0%)	0(0%)	1(100%)	1(100%)	1(100%)	1(100%)
Drafter	Hi.Tech	6(86%)	4(57%)	3(43%)	4(57%)	6(86%)	7(100%)	7(100%)	7(100%)	6(86%)
	Manuf.	1(100%)	0(0%)	1(100%)	0(0%)	0(0%)	1(100%)	1(100%)	1(100%)	1(100%)
Software Librarian	Hi.Tech	0(0%)	0(0%)	0(0%)	0(0%)	1(50%)	1(50%)	2(100%)	2(100%)	1(50%)
	Manuf.	0	0	0	0	0	0	0	0	0
Lab. Technician	Hi.Tech	3(60%)	1(20%)	2(40%)	0(0%)	2(40%)	4(80%)	3(60%)	5(100%)	5(100%)
	Manuf.	0	0	0	0	0	0	0	0	0

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Manager, Software Aide/Tape Librarian, or a Lab Technician. A close examination of the people skills used in each occupational title reveals the following:

Office Positions: All people related skills seem to be important for this occupational title. All percentage values that appear on Table 6 are greater than 67%, with the exception of the "Supervise" skill (for which only 43% of the job positions use this skill)

Production Manager: Only three of the people related skills were used in more than 50% of the job positions for this occupational title: Listen; Team Participation; and Initiate Work.

Computer/Equipment Operator: Only one of the nine people skills was NOT mentioned as being used by more than 50% of the job positions that fell into this occupational category. This skill related to the "Supervise" skill.

Computer Programmer: People related skills seem to be fairly important to the Computer Programmer. All but two of the nine skills were NOT mentioned as being used by more than 50% of the job positions as that fell into this occupational category. These two skills were: Supervise and Persuade.

Engineer/Technician: All but one of the people related skills are very important for this occupational category. The one skill is Supervise.

Control Analyst: Only one people related skill is NOT considered to be important for this occupational category: Supervise.

Drafter: All but one people related skill is not important for this occupational category: Supervise.

Software Aide/Tape Librarian: Very few people related skills seem to be important for this occupational category. Only three of the nine skills included on the survey were used by more than 50% of the job positions that fell into this occupational category. It is important that these job positions be able to Speak, Listen, and Participate on a Team.

Lab Technician: Four of the nine people related skills do NOT seem to be important to Lab Technicians: Instructing; Supervise; Persuade; and Initiate Work.

A comparison of the people related skills results obtained for the high technological companies to the results obtained for the manufacturing companies shows a difference in skills required for all five occupational titles for these two types of companies. In Office Positions, the manufacturing companies seem to NOT require the following people related skills of as many job positions as do high technological companies: Instruct; Persuade; Initiate Work; and Write.

For the Computer Programmer occupational category, the manufacturing companies were similar to the high technological companies relative to all but one people related skill: Write. Substantially fewer job positions in manufacturing companies required this skill (33%) compared to the job positions in high technological companies (80%).

The occupational title category for which there seemed to be the biggest difference between high technological and manufacturing companies in regards to people related skills was the Engineer/Technician category. Substantially, fewer job positions for the manufacturing companies required skills in: Negotiating; Instructing; Supervising; Persuading; Initiating Work; Writing; and Participating on a Team. It appears that high technological companies expect more people skills from their Engineers/ Technicians than do manufacturing companies. See Appendix G for a more specific description of people related skills required of various job positions..

Results for Objective 4: Identify equipment related competencies required to work productively for each occupational title

Six Equipment related skills were included on the phone interview survey:

a. Create flowcharts that display entire systems--that identify various parts of a system and their interrelatedness;

b. Analyze or evaluate the equipment for the purpose of problem identification;

c. Analyze or evaluate the equipment for the purpose of identifying solutions to existing problems;

d. Create programmes for or set up technical, computerized equipment that will permit the equipment to perform specific functions;

e. Operate equipment--start and stop the equipment to make it perform the job it is designed to perform; and

f. Maintain the equipment--replace parts of the equipment that need to be replaced based on a diagnostic analysis

Table 7 presents results obtained for each occupational title regarding equipment related skills. The results indicate that there is at least one equipment related skill that is important for each occupational title. This implies that each occupational title is involved in some way with some form of high technological equipment. The occupational title categories that require rather diverse skills (i.e. require several equipment related skills) include: Computer/Equipment Operator; Computer Programmer; Engineer/Technician; and Drafter.

Following is an overview of the skills used frequently for each occupational category:

Office Positions: This occupational category seems to require the majority of related job positions to Create flowcharts of some kind and Operate some form of high tech equipment.

Table 7: Results Obtained for Equipment Related Skills for High Tech and Manufacturing Companies

Job Title	Co. Type	Equipment Related Skills: Create Flowcharts	Identify Problems	Solve Problems	Create Programmes	Operate Equip.	Maintain Equip
Office	Hi.Tech	11(52%)	8(38%)	6(29%)	7(33%)	16(76%)	3(14%)
	Manuf.	1(12%)	1(12%)	4(50%)	3(37%)	8(100%)	7(87%)
Product Manager	Hi.Tech	1(25%)	3(75%)	2(50%)	4(100%)	2(50%)	1(25%)
	Manuf.	0	0	0	0	0	0
Equipment Operator	Hi.Tech	3(43%)	4(57%)	5(71%)	5(71%)	6(86%)	2(29%)
	Manuf.	0	0	0	0	0	0
Computer Programmer	Hi.Tech	4(80%)	4(80%)	4(80%)	5(100%)	4(80%)	0(0%)
	Manuf.	3(100%)	2(67%)	2(67%)	3(100%)	3(100%)	2(67%)
Engineer/ Technician	Hi.Tech	41(55%)	65(87%)	65(87%)	48(64%)	65(87%)	5(76%)
	Manuf.	1(20%)	3(60%)	3(60%)	2(40%)	5(100%)	1(20%)
Control Analyst	Hi.Tech	1(17%)	4(67%)	3(50%)	0(0%)	3(50%)	3(50%)
	Manuf.	0(0%)	1(100%)	1(100%)	0(0%)	1(100%)	0(0%)
Drafter	Hi.Tech	2(29%)	4(57%)	4(57%)	5(71%)	6(86%)	4(57%)
	Manuf.	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Software Librarian	Hi.Tech	1(50%)	1(50%)	1(50%)	1(50%)	2(100%)	0(0%)
	Manuf.	0	0	0	0	0	0
Lab Technician	Hi.Tech	1(20%)	4(80%)	2(40%)	1(20%)	5(100%)	1(20%)
	Manuf.	0	0	0	0	0	0

Production Manager: There are two equipment related skills that seem predominant in this occupational category: Analyze or evaluate the equipment for the purpose of problem identification and Create programs for or set up technical, computerized equipment.

Computer/Equipment Operator: This occupational category requires all equipment related skills included on the survey with the exception of two: Create flow charts and Maintain equipment.

Computer Programmer: All equipment related skills are required for this category with the exception of Maintain equipment.

Engineer/Technician: All equipment related skills are required for this occupational category.

Control Analyst: Only one equipment related skill was predominant for this occupational category: Analyze equipment for the purpose of identifying problems.

Drafter: All but one equipment related skill is required for this occupation. The exception is Create flowcharts.

Software/Tape Librarian: Only one equipment related skill is required for this occupation. These employees need to be able to operate equipment.

Lab Assistant: Two equipment related skills are required for this occupation: Analyse equipment for the purpose of problem identification and Operate equipment.

The manufacturing companies provide a different profile than the one presented by the high technological companies in regards to equipment related skills used. For Office Positions, the manufacturing companies did not request their employees to Create

flow charts. And a substantially greater percent of job positions that fell into this occupational category required employees to Maintain equipment.

Computer Programmers in the manufacturing companies were similar to those in high technological companies with the exception of one equipment skill. More job positions in the manufacturing companies required employees to Maintain equipment compared to the job positions in the high technological companies.

As with the people related skills, the equipment skills for Engineers/Technicians in the manufacturing companies are quite different from equipment skills for the same occupational category in the high technological companies. Three equipment skills were different. Manufacturing companies do not require employees to Create flow charts, Create programms, or Maintain equipment; whereas high technological companies have employees use these skills. See Appendix G for a more specific description of job competencies required of various job positions.

Results for Objective 5: Identify core competencies related to data/information, people, and equipment that are generic to all advanced technological fields

Table 8 presents a summary of the degree to which data/information, people and equipment skills are required for high technological and manufacturing companies. All data/information skills are used frequently in high technological companies. Each data/information skill can be considered to be a core competency for associate degreed persons employed in a high technological company.

The people related skills that are definitely core (percentage is greater than 50%) for associate degreed persons include: Listening; Speaking; Participating on a Team; and Writing. People related skills that seem to be fairly consistently required for high technological companies include: Negotiating; Initiating Work; Instructing; and Persuading. Only one people skill received an overall percentage score that fell below 50%--Supervise.

Table 8: Overall Skills Required for High Tech and Manufacturing Companies

Skill Type	Skill	Company Type High Tech. (n=132 jobs)	Manuf. (n-18 jobs)
Data/Information	Synthesize	97(73%)	11(61%)
	Compile	108(82%)	14(78%)
	Compute	95(72%)	9(50%)
	Copy	96(73%)	10(55%)
People	Negotiate	90(68%)	12(67%)
	Instruct	82(62%)	8(44%)
	Supervise	54(41%)	4(22%)
	Persuade	70(53%)	3(17%)
	Initiate Work	89(67%)	6(33%)
	Write	110(83%)	8(44%)
	Speak	127(96%)	18(100%)
	Listen	132(100%)	18(100%)
	Team Participate	122(92%)	11(61%)
Equipment	Create flow charts	65(49%)	5(28%)
	Analyze-problem identification	97(73%)	7(39%)
	Analyze-problem solution	92(69%)	10(55%)
	Create programms	76(57%)	8(44%)
	Operate equipment	109(82%)	17(94%)
	Maintain equipment	71(53%)	10(55%)

Supervising cannot be considered to be a core people skill requirement.

One equipment related skill that is definitely core to associate degreed persons is: Operate equipment. Equipment related skills that may also be considererd to be core include: Analyze or equipment for problem identification , Analyze equipment for identifying a solution to a problem; Create programms; and Maintain equipment. One equipment related skill that is NOT core for all occupational categories in high technological companies is: Create flowcharts.

Results for Objective 6: Identify technological equipment used for each occupational title

There were eight types of high technological equipment identified for this study:

1. computers
2. test equipment/calibration
3. size-metric equipment
4. photometric equipment
5. circuit boards
6. microwave
7. drafting equipment
8. process control system

The type(s) of equipment used for each occupational title and the corresponding percent of job positions within that occupational title category that uses the equipment follows:

Office Positions: Computers (62%)

Production Managers: Test/calibration equipment (75%)

Computer/Equipment Operator: Computers (71%); test/calibration equipment (29%)

Computer Programmer: Computers (100%)

Engineer/Technician: Test/calibration equipment (65%); computers (48%); drafting equipment (3%); process control system (3%); size metric equipment (3%); photometric equipment (1%).

Control Analyst: Test/calibration equipment (67%); computers (17%); circuit boards (17%)

Drafter: Computers (86%); test/calibration equipment (43%); drafting equipment (29%).

Software Aide/Tape Librarian: Computers (50%)

Lab Technician: photometric equipment (40%); test/calibration equipment (20%)

The most commonly used piece of high tech equipment across several occupational categories is the computer. The second most commonly used equipment is for testing/calibration purposes. Surprisingly, no company mentioned "robotics" as a piece of equipment used by associate degreed persons.

The only types of high tech equipment used by manufacturing companies are the computer and some form of testing/calibration equipment.

Results Obtained for Objective 7: Identify technological changes in equipment organizations envision will take place in the next five (5) years

The findings for this study question were obtained through the personal interviews with personnel directors. In the opinions of these personnel directors, the major changes in technology will be in the area of computers, software, and the use of both of these by

all employees in the companies. Based on the comments in Table 9, the trends will be for more employees to use computers and/or computer-assisted equipment in their daily job, whether the job is custodian or chief executive officer. More testing equipment in the quality control laboratories will be computer-based. A limited number of companies will be changing some of the product lines to meet new market demands such as the compatibility of software products.

In general, the personnel directors felt that every employee should have some keyboard skills so tht they can access software programmes needed in their jobs, even though the jobs may not be considered as "high tech" in today's employment market.

Results Obtained for Objective 8: Identify additional skills required by these technological changes

In addition to the keyboard skills in the findings for survey objective #7, the concern was for more emphasis on communication skills (both oral and written), interpersonal skills, and personal attributes. In the opinion of these personnel directors, the entry-level, associate degreed person interested in high tech and/or other jobs with their companies, should have the following skills:

1. knowledge of the field;
2. communication skills to understand written instructions;
3. communication skills to understand and give oral instruction;
4. computation skills to understand if there are problems with the programmes;
5. interpersonal skills because in most cases the employees work in team settings and must be able to communicate and get along with their fellow employees;
6. personal attributes such as concern for a quality product, pride in the final product, and the ability to work independently.

Table 9 presents an overview of data obtained for this study

TABLE 9: COMMENTS BY INTERVIEWEES TO SPECIFIC QUESTIONS ON SUCCESSFUL PROGRAMS IN COMMUNITY COLLEGES, AREAS WHICH NEED TO BE INCLUDED, CHANGES IN TECHNOLOGY IN THE NEXT FIVE YEARS, AND COOPERATIVE EDUCATION/ INTERNSHIPS WITH COMMUNITY COLLEGES

CORPORATION (Major product)	SUCCESSFUL PROGRAMS	AREAS TO BE INCLUDED	CHANGES IN TECHNOLOGY	COOPERATIVE EDUCATION
A - Computers (software)	SFCC Program in computers	A terminal project which includes design, coding, testing, and reporting.	software enhancement	YES -WITH OTHER COLLEGES Difficulty with CC because interns must be paid. (Company policy).
B - (Electronic signs)	Very satisfied with CC programs	More communication skills (written and oral)	Simplying product so that repairs are easier.	NO - but interested.
C - (Electronics)	Drafting	Emphasis on reading and writing.	Change to new products in micro-processors.	None at this time. Willing to explore.

D - (Aeronautics)	Several excellent programs. Cooperative planning with corporate staff and faculty.	More communication skills Concerned about basic skills in math and language.	Every employee will need to have basic computer skills.	None at the CC level. A number of exchange/ intern program with eng.schools
E - (Electronic Communications Equipment)	Cooperation with special faculty.	More emphasis on personal attributes -- attendance, promptness.	More technology in in every job.	None - could be interested.
F - (Data Processing)	None at this time.	More emphasis on a sense of direction for students.	Need for typing/ keyboard skills for all employees.	None - but top management may consider it.
G - (Chemical Analysis)	SCC Program in electronics	Writing skills	More technology in all jobs	Yes - with one college on a grant.
H - (Computer Equipment)	None at this time	More emphasis on communications	More apprenticeships	None - could be willing.
I - (Testing Equipment)	Electronic program - very good	More emphasis on writing (grammar and spelling)	very limited development	None - might be interested.

TABLE 10. SUMMARY OF TOP THREE COMPETENCIES REQUIRED FOR THE NINE IDENTIFIED ASSOCIATE DEGREED POSITIONS IN HIGH TECHNOLOGY COMPANIES

POSITION	EQUIPMENT USED	COMPETENCIES		
		DATA/INFORMATION	PEOPLE	EQUIPMENT
Office Staff	Computers	Compile Copy Synthesize	Speak Listen Work on team	Operate equipment Create flowcharts Identify problems
Production Manager	Test/Calibration equipment	Compute Compile Copy	Listen Work on team Initiate	Create programmes Identify problems Solve problems
Equipment Operator	Computers	Compile Compute Synthesize	Listen Work on team Speak	Operate equipment Solve problems Create programmes
Computer Programmer	Computers	Compile Compute Copy	Listen Speak Work on team	Create programmes Solve problems Operate equipment
Engineer/ Technician	Test/calibration equipment Computers	Compile Synthesize Copy	Speak Listen Work on team	Solve problems Operate equipment Identify problems
Control Analyst	Test/calibration equipment	Synthesize Copy Compile	Speak Listen Work on team	Identify problems Solve problems Operate equipment

TABLE 10 (Cont'd.)

Drafter	Computers	Synthesize Compile Compute	Write Speak Listen	Operate equipment Create programmes Solve problems
Software Aide/ Librarian	Computers	Synthesize Compile Compute	Speak Listen Write	Operate equipment Identify problems Solve problems
Laboratory Technician	Photometric equipment	Compute Compile Copy	Work on team Listen Speak	Operate equipment Identify problems Solve problems

objective. These additional job skills do NOT differ greatly from those which are needed for today's employment. This lack of difference could be because the jobs will not change or because the personnel directors were not able to predict the future.

Results Obtained for Objective 9: Identify the extent to which businesses, using advanced technology, are interested in forming a link with education in providing work experience for students.

In every company involved in the interview, the personnel directors were interested in developing cooperative education experiences with students from the community colleges. Most had not been contacted by the community colleges for these experiences. In one company, the policy is to pay the interns and the community college would not allow this.

Conclusions

The following conclusions are based on this study of the job competencies needed by associate degreed employees in high-technology companies. Therefore, each conclusion is focused on the associate degreed person and his/her involvement in the high-technology corporation. Each conclusion is referenced to the body of the report by the page number indicated at the end of the statement.

1) In general, the high-technology companies employ associate degreed persons. (p. 23)

2) In these working environments, most associate degreed persons utilize some form of high-tech equipment to perform their jobs. The most commonly used types of high-tech equipment are the computer and testing equipment. (p. 22)

3) Associate degreed persons are most frequently employed in high-tech companies as engineer/technicians or in office-related positions. (p. 24)

4) The **Data/Information-Related Competencies**, in rank order of identified importance, for the associate degreed employee are:

   a) compile, gather, collate, or classify data/information;

   b) synthesize or integrate data/information for the purpose of making decisions about the job;

   c) copy, transcribe, and/or enter data/information so it can be analyzed;

   d) perform, data analysis--compute mathematical operations and report outcomes. (p. 25)

5) The **People-Related Competencies**, in rank order of identified importance, for the associate degreed employee are:

   a) listen to and follow directions given by others;

   b) speak or talk with others to convey or change information;

   c) participate on a team--work with others for the purpose of problem solving;

   d) write or exchange information in writing;

   e) negotiate or exchange ideas, information, and opinions with others in a decision-making process;

   f) initiate work projects (i.e., be an independent worker);

   g) instruct or teach others about some aspect of the job;

   h) persuade or influence others in favor of a product, service, or point of view;

   i) supervise other workers. (p. 28)

6) The **Equipment-Related Competencies**, in rank order of identified importance, for the associate degreed employee are:

a) operate equipment--start and stop the equipment to make it perform the job it is designed to perform;

b) analyze or evaluate the equipment for the purpose of problem identification;

c) analyze or evaluate the equipment for the purpose of identifying solutions to existing problems;

d) create programs for or set up technical, computerized equipment that will permit the equipment to perform specific functions;

e) maintain the equipment--replace parts of the equipment that need to be replaced based on a diagnostic analysis;

f) create flowcharts that display entire systems--that identify various parts of a system and their interrelatedness. (p. 32)

7) In the future, more testing equipment in the quality control laboratories will be computer-based.

8) In the future, all employees in high-technology companies will be required to have keyboard skills of a level necessary to enter data into a computer. In addition, associate degreed employees will need to enhance their communication skills, both written and oral, and will need to advance in their interpersonal skills because of the increased amount of teamwork. (p. 38)

9) In general, the high-technology companies were pleased with the employees with community college educations. The need for improved communication skills and interpersonal skills was identified. Most companies expressed an interest in a cooperative work experience for students and would be willing to discuss these cooperative opportunities, if contacted. (p. 43)

10) Table 10 indicates the three top identified job competencies for each of the nine associate degreed positions in the high-technology companies.

SECTION III

ANALYSIS OF DEMAND/SUPPLY DATA IN RELATION TO COMMUNITY COLLEGE TRAINING PROGRAMS IN THE STATE OF WASHINGTON

> **Technology will change, businesses will change, the content of a given job will change, and one's employer will change. What will never change is the need to adapt to new opportunities.**
> Panel on Secondary School Education for the Changing Workplace, 1984.

Methodology

In carrying out the analysis, the investigators utilized existing data on jobs, employment, and training.

Information available on job supply and demand, job training programs, and community college training programs was taken from the 1985 Washington State Department of Employment Security comprehensive report, Occupations in the Labor Market, distributed through the Commission on Vocational Education (CVE).

All occupational clusters were listed and ranked initially by total demand. There were a total of 160 occupational clusters listed. Since there was a preponderance of data inplicit in all 160 clusters, the investigators decided to isolate clusters which indicated a significant level of demand and/or supply. Thus, the clusters were ranked according to the top and bottom twenty ocupations in demand as well as according to the top and bottom twenty sources of manpower (supply). Figures for demand and supply represent annual projections.

Data from the CVE study listed manpower supply sources from

institutions with less than four years training and those with training programs of four years length or longer.

The manpower supply from Washington community colleges were then extracted from the total supply. The clusters were then analyzed, noting the "fit" between annual occupational demand, total supply, and the number of graduates from community college programs.

The occupational clusters and community college training programs could not be matched exactly because clusters included specific occupations while training programs tended either to be broader and more generic in nature or were for a specific job title not listed in the clusters. The information in the report must be interpreted with caution for several reasons. First, the information is developed on a statewide basis, not taking into account local labor market variations. Accurate labor market reports for specific areas of the state were not yet available. Secondly, all of the "pieces of the puzzle" were not known; for instance, while the supply of trained people from occupational training programs was known, the number of individuals who were not graduates of training programs, or who may have been trained on the job and were seeking employment could not be determined from existing data. Thirdly, where opportunities for expansion or addition of training programs appeared to exist, it is important to look further at such factors as local labor market needs, program cost, and typical entry path ways into the occupation. This study did not include this analysis. Finally,

major occupations were selected for analysis, but a number of occupational areas for which community college training is or could be available were not included in the demand/supply clusters in this study.

Analysis of Top 20 Demand Clusters

The top twenty demand clusters addressed in detail in the following pages were characterized by significant supply shortages in the top six cluster areas. Five of them were also projected as high growth areas.

Community colleges currently have programs in all but three of the top 20 clusters areas (600, 30, and 505). Conclusions and recommendations regarding future program expansion and/or implementation are offered in the cluster detail section of this report.

Cluster 535 - Clerical Occupations

This cluster included entry level, high turnover clerical occupations such as general clerk, receptionist, file clerk and switchboard operator. The demand was high; the community college supply was low, as was the supply in general. Although they are producing 22.6 percent of the total supply, community college short-term certificate programs could be increased in numbers as the total supply is meeting only 2.75 percent of total demand. As many adults enter community college programs to enhance their entry level clerical skills, attracting students to these programs has not been a problem. The occupation still employs

Table 11: Detailed Overview Of Top Twenty Clusters Showing Most Demand

Rank	Cluster Name	Cluster Name	Total Demand	Total Supply	% of Supply Trained By Comm. Colleges
1	535	Clerical Occupations	7551	208	23
2	450	Wholesale & Retail Mktg. & Sales	7072	2806	5
3	5	Business Admin & Management	6848	3209	5
4	580	Cooking & Baking Services	6694	194	21
5	575	Restaurant Services	6074	47	21
6	600	Institutional & Home Support Serv	2976	129	0
7	510	Bookkeeping & Acctg. Clerks	2698	2262	13
8	525	Secretaries & Stenographers	2562	1601	15
9	300	Nursing & Related Services	1932	985	38
10	455	Food Store Marketing	1790	519	2
11	265	Registered Nurse	1775	1260	65
12	30	Engineering	1620	1236	0
13	850	Carpenters	1592	443	12
14	720	Motor Vehicle Operators	1430	184	16
15	555	Law Enforcement Occupations	1332	511	22
16	505	Accountants	1095	778	0
17	515	Banking & Finance	1040	293	1
18	530	Typing & Word Processing	914	4255	2
19	725	Material Handling Equipment Op.	898	126	10
20	865	Electricians & Power Transmission	888	132	20
		Bottom Occupational Clusters Showing Least Demand			
1	190	Dancers	26	12	0
2	80	Mathematical Scientists	25	276	0
3	585	Home Furnishings & Design	24	124	2
4	855	Boat Building	23	8	0
5	800	Small Engine Repairers	21	79	13
6	910	Saw Filing	18	0	0
7	310	Optometrist	17	0	0
8	225	Religious Studies	15	165	0
9	410	Educational Assisting	15	2	0
10	350	Speech & Hearing Technology	13	137	0
11	175	Actors & Directors	9	96	0
12	950	Precision Optical Workers	9	16	0
13	635	Animal Science	8	204	0
14	670	Agricultural Business & Mgmt.	8	116	0
15	615	Massage	6	0	0
16	305	Podiatrist	6		0
17	440	Museum Workers	5	0	0
18	640	Veterinarians	4	90	0
19	105	Nuclear Technology	2	11	0

large numbers of minimally or OJT trained individuals, however, so graduates must compete. It is, and will continue to be, however, a high demand occupational area.

Cluster 450 - Wholesale & Retail, Marketing & Sales

This cluster includes a variety of related occupations such as sales representatives, cashiers, delivery drivers, managers and buyers.

Community college programs were meeting only 4.82 percent of the total supply. Occupations in this cluster range from entry level requiring little or no training to those requiring a degree from a four-year college or university. It appears that community college programs can be expanded, however, as the supply from community colleges is not meeting the demand in those occupational areas traditionally served by two-year associate degree or less than two-year certificate programs (clerk, cashier, sales representation).

Cluster 5 - Business Administration and Management

This cluster includes managers and supervisors. Community college programs were meeting only 4.77 percent of the supply for this high demand occupational area. Competition for jobs in this cluster is keen as the four-year college and university business program graduate is often the person for whom the employer is looking. Data gathered did not separate the demand for small business managers from the demand for managers in general. It appears, however, that the demand for training for the person seeking employment in a small business or going into business for

him/herself is increasing. These are areas for continued expansion and modification of community college programs.

Cluster 580 - Cooking and Baking Services

This cluster includes fast food workers, kitchen helpers, cooks, bakers, supervisors, and cashiers. With the exception of the supervisors, occupations in this cluster were entry level, characterized by high turnover. The demand is high, and the supply is low. Although community colleges produce 20.62 percent of the supply, the total supply is only 2.90 percent of the total demand. Community colleges could increase short-term training opportunities in this cluster area. Of the occupations within this cluster, training for cooks and bakers seems to be in high demand. Fast food services positions are also in high demand, but training in this area traditionally is on the job.

Cluster 575 - Restaurant Services

This cluster includes waiter/waitress, host/hostess, bartender, and restaurant managers. According to the data, community college programs were providing only waiter/waitress training for this cluster at the time of analysis. Total supply from all sources was 47. Although community colleges provided 20.62 percent of this total, all sources were providing 0.77 percent of the total demand. Therefore, there appears to be a large unmet need suggesting broadening short-term training, especially for waiter/waitresses. Restaurant services is another vocational area community colleges should definitely consider expanding. This type of training is not capital intensive as

is the training of cooks. Attracting students to training is a potential problem, however, because on-the-job training is still available to a large extent.

Cluster 600 - Institutional and Home Support Services

This cluster includes housekeepers, janitors, and house cleaners. At this time community colleges are providing no trained employees for this cluster. All sources are meeting only 4.33 percent of the demand. It appears short-term training programs, especially for janitors and building maintenance persons, should be considered by community colleges to help meet the high demands of this cluster. Attracting persons to such training programs is a potential problem, however, because of the social stigma still attached to the occupation perceived as comprising menial labor (requiring low level skill and little or no training).

Cluster 510 - Bookkeeping and Accounting Clerk

This cluster includes bookkeepers, accounting clerks, payroll clerks, and banking clerks. Community college programs are meeting 13.4 percent of the supply needs. One-year certificate and two-year associate degree programs exist in many community colleges. Competition exists from those graduating from four-year college and university business programs for what are considered entry level accounting jobs. Supply from all sources is meeting 83.83 percent of the demand, which indicates a fairly even match of training and demand. Community colleges should study their area's needs before starting new or expanding

existing programs in this cluster area.

Cluster 525 - Secretaries and Stenographers

Included in this cluster were secretaries, stenographers, and court clerks. Community colleges were providing 14.55 percent of the supply. Even though most community colleges have secretarial programs, expansion in this cluster area is indicated as only 62.49 percent of the demand is being met from all supply sources. This field of training is undergoing rapid change to meet the needs of the automated office - an occupation included in cluster 530 where supply exceeds demand. Perhaps because of overlapping training and job demands, clusters 525 and 530 should be considered together. If this were the case, total demand is 4376; supply, 5856; the community college contribution to this annual supply pool is 334 persons (5.70 percent). As demand in these two cluster areas combined is 59.36 percent of supply when looking at the clusters together they suggest reduction in community college training programs rather than expansion. It should be noted, however, that keyboarding skills are demanded in all occupations where interaction with a word processor or computer is part of the job. If cluster 535 were included, the picture would change again as this is the highest demand cluster with a low percentage of supply. The overlap between clusters 525 and 535 combined with the lower demand of cluster 530, indicates a move away from programs which promote word processing as a terminal occupation. The data suggest that this skill may be viewed as one competency required to work in today's

business environment. This observation would further suggest careful consideration of the continuation of offering word processing training as a separate program.

Cluster 300 - Nursing and Related Services

Included in this cluster were nurse aides/orderlies and practical nurses. Community college programs were providing 38.07 percent of the supply for these entry-level health occupations--especially nurse aides.

Current data suggest the demand for practical nurses is decreasing. Therefore as community colleges supply 51.26 percent of the demand in this occcupation, no expansion is indicated. However, as nurse aide is a high turnover, entry level occupation and commuity college programs meet only 3.78 percent of the demand, expansion of short-term training programs would be thought to be indicated. Demand may be peculiar to specific areas of the state, however, and in specific institutional settings, i.e., nursing homes. Attracting students can be a problem, because of low salaries, restricted upward mobility, and limitations in facilities which will hire nurse aides. The long term future for nurse aides is not clear. Therefore, caution needs to be taken in planning for additional programs in the community college system.

Cluster 455 - Food, Store, Marketing

Included in this cluster were food store cashiers, clerks, baggers, buyers, reps and managers. Community colleges were only supplying cashiers at the time of analysis, and were only meeting

1.46 percent of the demand in cashier category of the cluster. This information suggests that expansion of short-term training programs in community colleges is appropriate to provide trained entry-level checkers in this high demand area in which the supply from all sources meets 28.99 percent of the demands of all categories included in the cluster. As community college programs are apparently not providing managers or sales representatives, research to determine whether there is a need to emphasize the food store area in existing business management programs appears appropriate.

Cluster 265 - Registered Nurses

The professional registered nurse was the only occupation included in this cluster. Community college associate degree nursing programs were providing 65.16 percent of the total supply. As 70.99 percent of the demand was met by the supply from all sources and community college graduates compete with graduates from four-year programs in a currently declining job market, expansion of existing or introduction of new programs is not indicated at this time. Data gathered for this study indicated continued growth (800) in this cluster. However this appears to be true in specialty areas where experienced nurses are required, not in the general nurse category, which is the predominate entry-level for the associate degree graduate.

Cluster 30 - Engineering

This cluster included electrical, electronic, aeronautical, civil, and mechanical engineers. These positions require at

least a four year degree. Community college programs provide qualified technicians. Therefore they were not supplying any engineers to meet the demands of this cluster.

Cluster 850 - Carpenters

Included in this cluster were carpenters, carpenter helpers, roofers, tapers, and insulation workers. Community college programs were providing 11.96 percent of the supply with all supply sources meeting 27.83 percent of the demand. Community college programs were meeting 39.26 percent of the demand for carpenter helpers--the apparent predominant entry level for community college program graduates. Although data suggest the need for program expansion to meet the demands in this cluster, recent labor market data also point out high unemployment levels in this occupation. Therefore careful consideration should be given to program expansion or implementation. Further, the impact of in-migration of unemployed carpenters and helpers from other parts of the U.S. is not known, and data need to be available before community colleges can conclude that a greater supply of trained individuals through new or expanded program offerings is warranted.

Cluster 720 - Motor Vehicle Operators

The cluster of motor vehicle operators included truck, bus, and school bus drivers. The current demand is for 1,430. Over half (822) of the demand is attributable to growth in this occupational cluster. The community college system is training 29 truck drivers annually, or 16 percent of the supply available

to fill jobs in this cluster. The total available supply of trained truck and bus drivers is 184, or approximately one percent of the demand. This occupational cluster appears to offer potential for training.

Law Enforcement Occupations

Law enforcement occupations included guards, correction officers, jailers, police officers, and police detectives. Community colleges train criminal justice technicians and general law enforcement graduates. The current supply (511) equaled approximately 38 percent of the total demand (1332). The demand was primarily for guards, correction officers, and jailers. Over half of the jobs were due to replacement; the remaining were new jobs. Community colleges are training 22 percent of the total supply available, primarily criminal justice technicians. It appears that training programs which emphasize training for guards, correction officers, and jailers are potential growth areas.

Accountants

The cluster of accountants included accountants, auditors, tax preparers, and tax examiners. Nine-tenths of the jobs in demand were for accountants and auditors, generally requiring years of education. Consequently, no community college training is done in this cluster area, although preparatory transfer courses leading to a four-year degree are available.

Banking and Finance

This cluster included tellers, collectors, loan closers,

Table 12: Occupational Clusters Showing Most Supply

Rank	Cluster Name	Cluster Name	Total Demand	Total Supply
1	530	Typing & Word Processing	914	4255
2	5	Business, Admin & Management	6848	3209
3	450	Wholesale & Retail, Mktg & Sales	7072	2806
4	130	Social Scientists	87	2804
5	510	Bookkeeping & Acct Clerks	2698	2262
6	765	Automobile Mechanics	565	1884
7	70	Comp Program & System Analysis	528	1819
8	400	Teachers	92	1696
9	525	Secretaries & Stenographers	2562	1601
10	610	Personal Services	540	1512
11	750	Transportation Services	505	1465
12	265	Registered Nurses	1775	1260
13	30	Engineering	1620	1236
14	775	Diesel, Engine, Mechanics	160	1169
15	955	Food, Production, Occupations	69	1047
16	920	Welding Occupations	465	1013
17	40	Electrical & Electronic Tech	465	989
18	300	Nursing & Related Services	1932	985
19	805	Electronic Repairers	486	831
20	505	Accountants	1095	778
21	435	Library Assisting	116	25
22	685	Agricultural Products & Proces	303	18
23	295	Technical Health Services	43	16
24	675	Agricultural Services & Supplies	105	16
25	950	Precision Optical Workers	9	16
26	595	Drycleaning & Laundering	484	15
27	25	Architectural Design & Drafting	239	14
28	475	Insurance Sales Occupations	835	14
29	740	Air Traffic Control	44	14
30	790	Industrial Equipment Mechanics	438	14
31	190	Dancers	26	12
32	105	Nuclear Technology	2	11
33	315	Ophthalmic Services	55	8
34	855	Boat Building	23	8
35	110	Environment Technology	55	7
36	100	Chemical Technology	63	5
37	200	Advertising & Production	345	5
38	885	Extractive Occupation	53	5
39	240	Athletes & Related Workers	76	4
40	95	Physical & Bio Science Tech	373	2

Table 13: Detailed Overview Of Top Twenty Clusters Showing Most Demand

Cluster No.	Cluster Name	Demand	Supply	Comm. Coll. Supply	% Total Supply	Demand Growth	Demand Replace	
535	Clerical Occ.	7551	*208	47	22.60	3366	4185	*2.75% of demand met by supply from all sources. Low pay, high turnover
450	Wholesale Retail Mkt	7072	*2806	135	4.82	2835	4237	*3.98% of demand
5	Bus Admin & Mgmt	6848	*3209	153	4.77	3123	3725	*46.8% of demand Four-year degree orientation
580	Cooking & Baking Srv	6694	* 194	40	20.62	3871	2823	*2.90 Low pay, high turnover
575	Restaurant Services	6074	* 47	10	21.28	3883	2191	*00.77% Low pay, high turnover
600	Inst & Home Support Services	2976	* 129	0	0.00	1036	1940	*4.33% Low pay, high turnover
510	Bookkeeping & Acctg Clerks	2698	*2262	303	13.40	1178	1520	*83.83%
525	Secretarial & Stenog	2562	*1601	233	14.55	1312	1250	*62.49%
300	Nursing & Related Services	1932	* 985	375	38.07	810	1120	*50.98% Low pay, high turnover
455	Food, Store, Mktg	1790	* 519	** 12	2.31	676	1114	*28.99% **Cashier/checker only
265	Registered Nursing	1775	*1260	821	65.16	800	975	*70.99%
30	Engineering	1620	*1236	0	0.00	1082	538	*76.30% Four-year degree orientation
850	Carpentry	1592	* 443	53	11.96	1004	588	*27.83%

credit clerks, credit analysts, and some bank management jobs. Over half of the total demand (1040) was for tellers. The community college system trains approximately one percent of the total supply (293). The total supply is approximately 28 percent of the demand. Jobs are evenly distributed between growth and replacement. The cluster area appears to offer opportunities for new training programs, particularly for tellers.

Typing and Word Processing

This cluster included typists and key punch operators. There were no demand data available specifically for word processing jobs. Over 80 percent of the total demand was for typists. The community college system trains clerk typists, business data entry equipment operators, and word processors. The total suply (4255) far exceeds the demand. Community colleges contribute approximately two percent of the current supply. This cluster warrants no additions or expansions in training programs. It is apparent that training institutions outside of the community college system are contributing significantly to the supply.

Material Handling, Equipment Operation

This cluster includes heavy equipment operators, industrial truck operators and crane, derrick, and hoist operators. Community colleges train construction equipment operators. The total supply was 14 percent of the total demand (898). Community colleges contributed 10 percent of the total supply. Well over half of the jobs were new jobs, primarily in heavy equipment and

industrial truck operation. This cluster area appears to offer potential for adding or expanding training opportunities.

Electricians

This cluster includes electricians, installers/repairers, and line erectors. The demand (888) far exceeded the supply (132). Community colleges contributed 20 percent of the total supply training for the job of electricians. This cluster appears to offer opportunities for addition or expansion of training programs.

It should be noted that some occupations were not listed in the top or bottom twenty demand clusters but are commonly the result of community college training programs. They are as follows:

Job/Program	Demand	Grow	Repl	Supply	% Supply By CC's
Auto Mechanic	565	237	328	1884	26
Welding Occ.	465	235	230	1013	18
Electrical & Electronic	465	328	137	989	41
Diesel Engine Mechanic	160	76	84	1169	27
Computer Prog/Analysts	528	409	119	1819	60

In all of these occupations, supply far exceeds annual demand. Further, growth in these areas is not significant (less than half the jobs created will be due to growth). Community college programs should be curtailed or reassessed in these areas. Table 13 shows those occupational clusters showing the most significant annual demand. Again, it should be noted that real growth in these areas is modest.

FINAL CLUSTERS SELECTED FOR DETAIL REVIEW
(EXCLUDES CLUSTERS WHERE DEMAND OR
SUPPLY EQUAL ZERO)

CNUM	CLUSTER	TOTL.DEM	TOTL.SUP
5	BUSINESS.ADMIN.AND.MANAGEMENT	6048	3209
25	ARCHITECTURAL.DESIGN.&.DRAFTING	239	14
30	ENGINEERING	1620	1236
40	ELECTRICAL.&.ELECTRONIC.TECH	465	989
70	COMP.PROGRAM.&.SYSTEM.ANALYSIS	528	1819
80	MATHEMATICAL.SCIENTISTS	25	276
95	PHYSICAL.&.BIO.SCIENCE.TECH	373	2
100	CHEMICAL.TECHNOLOGY	63	5
105	NUCLEAR.TECHNOLOGY	2	11
110	ENVIRONMENTAL.TECHNOLOGY	55	7
130	SOCIAL.SCIENTISTS	87	2804
175	ACTORS.&.DIRECTORS	9	96
190	DANCERS	26	12
200	ADVERTISIND.&.PR	345	5
225	RELIGIOUS.STUDIES	15	165
240	ATHLETES.&.RELATED.WORKERS	76	4
265	REGISTERD.NURSES	1775	1260
295	TECHNICAL.HEALTH.SERVICES	43	16
300	NURSING.&.RELATED.SERVICES	1932	985
315	OPTHALMIC.SERVICES	55	8
350	SPEECH.&.HEARING.TECHNOLOGY	13	137
400	TEACHERS	92	1696
410	EDUCATIONAL.ASSISTING	15	2
450	WHOLESALE.&.RETAIL.MKTG.&.SALES	7072	2806
455	FOOD.STORE.MARKETING	1790	519
475	INSURANCE.SALES.OCCUPATIONS	835	14
505	ACCOUNTANTS	1095	778
510	BOOKKEEPING.&.ACCTG.CLERKS	2698	2262
515	BANKING.&.FINANCE	1040	293
525	SECRETARIES.&.STENOGRAPHERS	2562	1601
530	TYPING.&.WORD.PROCESSING	914	4255
535	CLERICAL.OCCUPATIONS	7551	208
555	LAW.ENFORCEMENT.OCCUPATIONS	1332	511
575	RESTAURANT.SERVICES	6074	47
580	COOKING.&.BAKING.SERVICES	6694	194
585	HOME.FURNISHINGS.&.DESIGN	24	24
595	DRYCLEANING.&.LAUNDERING	484	15
600	INSTITUTIONL.&.HOME.SUPPORT.SERVI	2976	129
610	PERSONAL.SERVICES	540	1512
635	ANIMAL.SCIENCE	8	204
640	VETERINARIANS	4	90
665	PLANT.&.SOIL.SCIENCES	28	716
670	AGRICULTURAL.BUSINESS.&.MGMT	8	116
675	AGRICULTURAL.SERVICES.&.SUPPLIES	105	16
685	AGRICULTURAL.PRODUCTS.&.PROCESSIN	303	18
720	MOTOR.VEHICLE.OPERATORS	1430	184
725	MATERIAL.HANDLING.EQUIPMENT.OP	898	126
740	AIR.TRAFFIC.CONTROL	44	14
750	TRANSPORTAION.SERVICES	505	1465
765	AUTOMOBILE.MECHANICS	565	1084
775	DIESEL.ENGINE.MECHANICS	160	1169
790	INDUSTRIAL.EQUIPMENT.MECHANICS	438	14
800	SMALL.ENGINE.REPAIRERS	21	79
805	ELECTRONIC.REPAIRERS	486	831
850	CARPENTERS	1592	443
855	BOAT.BUILDING	23	8
865	ELECTRICIANS.&.POWER.TRANSMISSION	888	132
875	STRUCTURAL.IRONWORKERS	106	1
885	EXTRACTIVE.OCCUPATION	53	5
920	WELDING.OCCUPTIONS	465	1013
925	DEEP.WATER.DIVING	1	105
950	PRECISION.OPTICAL.WORKERS	9	16
955	FOOD.PRODUCTION.OCCUPATIONS	69	1047

OK.

Analysis of Bottom Twenty Demand Clusters

The bottom 16 occupational clusters included only two current training programs from the community college system. Small Engine Repairer showed a total demand of 21 and total supply of 79. The community colleges supplied 10, or 12.66 percent of the supply. This occupational cluster would not be recommended for continuation in a community college at this time. Deepwater Diving showed a demand of 1, a supply of 185, and a community college supply of 26. The demand was for Washington State only. Current program graduates have a high rate of employment out of state. Current programs should stay in existence as long as placement is high whether in or out of state.

Three occupational clusters in the bottom 16 may be considered for one institution in the state as the supply does not meet the demand. Saw, Filing has a demand of 18, zero supply, and no community college program. Educational Assisting had a demand of 15, a supply of 2, and no community college program. However, two educational secretary completers were reported in 1983-84 from community college reports. Optometrist had a demand of 17, supply of zero, and no community college offering the program. The nature of the accreditation requirements and extended studies may not be conducive with the two-year structure of community colleges, although this program may be studied for one institution in the state.

Table 14: Detailed Overview Of Occupational Clusters Showing Least Annual Demand

Rank	Cluster No.	Cluster Name	Growth	Replace	Total Demand	Total Supply	CC Supply	% CC Supply
1	190	Dancing	10	16	26	12	--	--
2	80	Mathematical Science	16	9	25	276	--	--
3	585	Home Furnishings/Design	10	14	24	124	2	1.61
4	855	Boat Building	12	11	23	8	8	100
5	800	Small Engine Repair	9	12	21	790	10	12.66
6	910	Saw, Filing	4	14	18	0	--	--
7	310	Optometry	7	10	17	0	--	--
8	225	Religious Studies	6	9	15	165	--	--
9	410	Educational Assisting	6	9	15	2	--	--
10	350	Speech & Hearing Tech.	7	6	13	137	--	--
11	175	Acting & Directing	5	4	9	96	--	--
12	950	Precision Optical Work	5	4	9	16	--	--
13	635	Animal Science	3	5	8	204	--	--
14	670	Agricultural Bus. & Mgmt.	3	5	8	116	--	--
15	615	Massage	2	4	6	0	--	--
16	305	Podiatry	2	4	6	0	--	--
17	440	Museum	2	3	5	0	--	--
18	640	Veterinary Medicine	2	2	4	90	--	--
19	105	Nuclear Technology	1	1	2	11	--	--
20	925	Deepwater Diving	1	0	1	185	26	14.05

Table 15: Comparison Of 12 Occupational Clusters Showing High Supply To Demand

Cluster No.	Cluster Name	Total Supply	Total Demand	Ratio of Supply to Demand
130	Social Sciences	2804	87	32.2
70	Comp. Prog. & System Analysis	1819	528	3.44
400	Teaching	1696	92	18.43
610	Personal Services	1512	540	2.80
750	Transp. Services	1465	505	2.90
30	Engineering	1236	1620	.76
775	Diesel Engine Mechanics	1169	160	7.30
955	Food Production	1047	69	15.17
920	Welding Occupations	1013	465	2.17
40	Electrical & Electronic Technology	989	465	2.12
765	Automobile Mechanics	1884	565	3.33
805	Electronic Repair	831	486	1.70

Analysis of Top Twenty Supply Clusters

Those occupational clusters which indicated the highest level of supply are listed in Table 12. Only eight demand clusters were found in those clusters indicating occupations for which there were high numbers of available employees. These are listed in Table 16.

Table 16: Comparison of Occupational Clusters With Highest Level of Demand Level to Supply

Cluster		Rank Demand	Rank Supply
450	Wholesale & Retail Marketing and Sales	2	3
5	Busines Admin. & Management	3	2
510	Bookkeeping & Acct. Clerks	7	5
525	Secretaries & Stenographers	8	9
300	Nursing & Related Services	10	18
265	Registered Nurses	11	12
505	Accountants	16	20
530	Typing & Word Processing	19	1

As is indicated, there is agreement between demand and supply in clusters 450, 5, 510, 525, and 265 in terms of ranking. There is disparity between clusters 300, 505, and 530. Most notably, demand for word processors ranked 19th while supply of such persons ranked first. This indicates that the "fit" between supply and demand in these occupations is absent.

The remaining twelve clusters fall above the bottom twenty

demand clusters. However, as Table 15 shows, in eleven of these clusters, the supply of manpower far exceeds the demand. A detailed overview of these clusters, showing percent of supply from community college programs is found in Table 17.

Computer Programming & Systems Analysis

This cluster included systems analysts and computer programmers for business and science. The supply exceeded the demand by over 700 percent. Community colleges currently supply 18.14 percent of the supply. It appears that this occupation does not need more training programs. Competition for jobs is keen. Further current literature on computer-based employment in business suggests that individuals must have broader and more generalizable skills in order to remain employable. Therefore, programs which result in degrees or certificates in programming per se may be restricting the employment opportunities of the graduates.

Personal Services

This cluster included cosmetologists, hair stylists and barbers. The supply exceeds the demand by almost 300 percent. Community colleges supply 5.62 percent of the total supply (cosmetologists). It must be noted that this occupation is largely entrepreneurial and demand for services may in fact be higher than is apparent. What may be significant, however, is that need is most likely being met through self-employed persons in small businesses, rather than through employed individuals working for others. The job outlook does not indicate expansion

Table 17: Detailed Overview Of Selected Occupational Clusters Showing High Supply

Cluster No.	Cluster Name	Demand	Supply	Comm. Coll. Supply	% Total Supply	Demand Growth	Demand Replace	
70	Comp. Prog. & System Analysis	528	1819	331	18.19	409	119	
610	Personal Services	540	1512	85	5.62	231	309	Community colleges provide 195% cosmetologists
750	Transp. Services	505	1465	79	5.39	256	249	
805	Electronic Repair	486	831	30	3.71	328	158	
775	Diesel Engine Mech.	160	1169	146	12.49	76	84	
955	Food Production	69	1047	219	20.92	28	41	
920	Welding Occup.	465	1013	99	9.77	235	230	82% demand for welder/flame cutter
40	Electrical & Electronic Technology	465	989	227	22.95	328	137	
765	Automobile Mechanics	565	1884	143	7.59	237	328	

of any programs; however, because competition from private school graduates is extremely keen, programs should stress small business management skills as well as technical skills, due to the apparent shift to self-employment situations.

Food Production

This cluster included testers, inspectors, and managers. The community college system provided almost 21 percent of the supply, specifically for food production management services. With a ratio of fifteen individuals to every available position, this program area should be carefully considered as to the continued need and market for trained individuals.

Conclusions

The data suggest that annual demand through 1990 will be primarily in the service industry, specifically in marketing and sales, office clerical and secretarial services, and in cooking, baking and restaurant services. There are currently unmet manpower supply needs in these demand areas which have implications for vocational programs in community colleges. There are, on the other hand, several traditional training programs in community colleges for which there is no significant demand for graduates. In fact, total supply in Washington State far exceeds demand. These occupations are: diesel engine mechanics, welding, electrical technicians, automobile mechanics, computer programming/systems analysts, and typing and word processing. The data suggested that typing and word processing are now considered basic skills rather than occupations.

Community colleges should explore expansion/implementation in areas where demand far outweighs supply--especially clusters 535, 575, 450, 5, 580, 600, and 455. These are all clusters in which the total supply meets less than 5 percent of demand, or community collegs provide less than 5 percent of total supply.

It should be noted, however, that clusters 535, 580, 575, and 600 are all low-paying, high-turnover, entry-level occupations. The implications for training point to short-term programs with broad generalizable skills. Only three of the bottom 20 demand clusters were found in the bottom 20 supply clusters. They were:

855 Boat Building

950 Precision Optical Workers

105 Nuclear Technology

Clusters bearing consideration for program expansion/ implementation where supply is low and demand exceeds supply by more than 1000 percent appear to include:

Cluster #	Occupation	Demand	Supply
685	Agricultural Prod/Processing	303	18
595	Drycleaning and Laundering	484	15
25	Architectural Design/Drftg	239	14
475	Insurance Sales	835	14
790	Industrial Equip Mech	438	14
200	Advertising/Promotion	345	5
95	Physical/Bio Science Tech	373	2

SECTION IV

ANALYSIS OF RESOURCE SHARING MODELS IN WASHINGTON STATE

> **Flexibility in high tech offerings can be improved if the universities, community colleges, vocational programs, businesses, and economic development organizations in an area work together.**
> Battelle Institute, 1984

Introduction

The discussions in Sections I, II, and III of this report have clearly indicated the need for change in the delivery of vocational education in Washington state. The advance of technology will, in spite of the proliferation of "low tech" jobs, require new educational programs, modification of existing programs, and significant investment in both capital and human resources on the part of community colleges. At the same time, the funding base for Washington state community colleges will not significantly increase in the next decade.

Colleges will need to look at new and innovative ways to finance equipment and curriculum design in order to meet educational needs of diverse student and industry groups.

Methodology

The investigators went through a theoretical analysis initially and identified three factors which act as constraints upon decisions to consider resource sharing in the state

community college system. They were: (1) governance and structure, (2) funding allocation model, and, (3) geographical distribution of programs.

Next, the investigators searched for resource and capital equipment networking models in Washington state or other states which seemed to have addressed the constraining factors identified in the initial analysis in the following ways: (1) the models worked within existing community college structure; (2) the models did not disrupt the balance of FTE distribution among districts and did not appear to negatively impact funding models; (3) the models improved the ability of participating colleges to deliver planned vocational education and maintain enrollment levels with decreased budget costs in occupations requiring high resource expenditures.

Analysis of Constraints

1. Governance and Structure

The investigators found that Washington state community colleges are structured as highly autonomous districts with no consistent components of governance outside of district boards of trustees. The decision making and political processes vary greatly among the colleges, and there is a strong sense of "ones own territory," created in part by the very fact that each community college is to serve a specific area. Plans to share resources must move through each college's decision making process, and it may be difficult to convince all decision

makers of the mutual benefits of such and arrangement. Any joint venture between colleges will involve numerous actors, including faculty and student groups who, of necessity or principle are involved in the decision process. Since district budgeting practices and methods of determining priorities vary, decisions to commit resources to shared vocational education projects must first run the gauntlet of disparate program goals and objectives among colleges. Programs of high priority in one district may be of low priority in another. Resource sharing and networking requires long term planning and commitment. Many colleges limit planning and obligation of resources to the budget year, while others project into forthcoming bienniums. Community and political support vary among districts and exert positive and negative influence upon institutional decision makers. Answers to questions such as: On whose campus will shared resources be based? Which district will control or monitor use? When and how students will have access must be negotiated and are highly dependent upon political inclinations. These complex interplay of variables act as constraints upon resource sharing.

2. Funding Allocation Model

Although recently revised to make allocation of state funding to districts more equitable, the current model is still primarily driven by the generation of full-time equivalent enrollments (FTEs). Any decision promoting resource sharing among districts which impact FTE levels, which alter the distribution of FTEs, or which appear to shift owner- ship of

FTEs are directly linked to funding and budgets.

The allocation model does not allow adequate flexibility with which to creatively plan for manipulation of FTEs in order to meet institutional needs for shared resources to ultimately reduce the cost of vocational education. Resource and program duplication among districts is, in fact, encouraged by the push for one's own FTEs in order to meet allocation levels. At the same time, the dichotomy between the need to update and change education and the limitation of overall state support continues to be a compelling reason for finding economical means for educating students for today's occupations and technologically advanced work environments.

3. **Geographical Distribution of Programs**

The geographical location and distance between common community college programs which would benefit from resource-sharing agreements is not ideal in parts of Washington State. The distance between district programs in Eastern Washington would restrict resource sharing, especially in terms of student access. On the other hand, districts in Western Washington seemed fairly evenly distributed along the Puget Sound corridor, so that distance would not be viewed as a primary constraint.

Analysis of Resource-Sharing Models

1. **Campus Exchange**

The investigators identified several community colleges utilizing a campus exchange model. The exchange was occurring primarily between two colleges whose districts were in close

proximity to each other, and, communities served overlapped so that the potential for a mixing of student populations already existed. The model reduced the costs (both faculty and equipment) associated with vocational education by allowing an exchange of students between campus programs to utilize resources each participating campus already has. Agreements and the level of reciprocation have to be negotiated and must significantly involve faculty affected by the exchange. To maximize the financial offset effected by the exchange, participating campuses must receive mutually beneficial program outcomes. The model works best when student groups are relatively compact, and programs can be scheduled and offered in block units of time, i.e., two- to three-hour labs.

An example of this model was seen in exchange of the electronics program facilities at North Seattle Community College (NSCC) and the manufacturing program at Shoreline Community College (SCC). Electronics students at NSCC needing machine training on high tech machinery enroll in these courses on their own campus, but receive training at SCC. Likewise, manufacturing students needing electronics training with sophisticated equipment, utilize the electronics laboratory at NSCC, but enroll in the classes on their own campus. Both institutions maximize the effects of their respective curricula while avoiding the additional cost of equipment necessary to carry out instructional objectives.

2. Shared Equipment

The shared equipment model stresses pooled resources from participating colleges to purchase or commit equipment and/or other instructional resources for multicampus use. The model is intended to reduce costs of equipment in multicampus program areas in which economics of scale can be reached with a major equipment investment. Resources may be fixed, i.e., a technology center, and costs shared, or units can be moved from campus to campus for use on a rotational basis. The benefit of the model is seen primarily in its flexibility. Curricula associated with shared resources may be normalized or may be unique to each campus situation.

The model tends to foster a high degree of cooperation among campuses and may contribute to the reduction of program duplication. The most significant problems may be in maintaining the shared units, monitoring utilization, and in reaching agreement on when and how to update or change units when necessary.

Four community colleges in Southwestern Washington utilize a shared equipment model through a mobile training unit intended for units in the auto mechanics programs on the four campuses. Without the mobile unit, each campus would have to invest in separate inventories of expensive equipment. Individual campus enrollments and curriculum management are not affected by the unit.

Raymond Harry studied the implementation of mobile training

laboratories in 37 states (Harry, 1985). Harry found that units which were no longer in use were usually discontinued because: (1) mobile carriers were completely depreciated due to frequent movement from site to site over rough roads; (2) funding (usually special state or federal grants) was discontinued and could not or would not be replaced through regular institution budgets; (3) instructors were difficult to recruit or retain. (ibid, page 4).

Those units which were successfully operating were found to meet institutional needs effectively and economically. The following project outcomes were cited in the report:

1. Increased the access of vocational programs to students in institutions who could not financially support the program;

2. Fostered positive relationships with businesses and industries when units were located on business sites. "This training was, in most cases, correlated with the skills used in the workplace." (ibid, page 5);

3. Students received exposure to a greater variety of vocational programs. Also, in areas in which limited job opportunities for graduates cannot justify a full program, mobile units provide opportunities for training limited numbers of students;

4. Districts avoided the duplication of programs, equip-ment, and the over generation of student graduates.

Harry further states:

> **The efficiency of equipping one laboratory as opposed to several in the same instructional discipline means financial savings in both facilities and equipment. It is much more efficient to equip one good laboratory than several laboratories that are partially complete. The money spent on one mobile unit compared with**

capital facility construction is in most cases, much less, especially of the capital facilities are program specific." (ibid, page 7)

The colleges and universities found a significant weakness in the model which would need to be overcome. The movement of mobile units from site to site does restrict the flexibility of participating colleges in scheduling course offerings which rely on the equipment. This problem requires careful coordination, and long-term planning. The arrangement does not allow for rapid response to sudden changes in demands for classes.

3. **Consortium**

The consortium model is characterized by the establishment of a cohesive political and economic base through the combined efforts of several colleges. The consortium in reality becomes a collective extension of each college organization. Consortia seek to economize on all instruction costs, including human resources, by securing external support and funding. Consortia further strengthen each college's ability to finance vocational education through group advocacy and group lobbying. Benefits may not always be mutual, but may rotate between campuses.

The willingness of participating colleges to share power, seek common areas of need, and lose some individual identity and autonomy contribute significantly to the success and longevity of a consortium.

Between 1983 and 1985, a consortium of five community colleges in Western Washington was funded through a Washington State High Technology grant. The consortium reduced the

financial burden of each participating college in the purchase of high technology equipment in the following ways:

1. The colleges identified common programs needing high cost equipment in engineering technology, machine shop, and business technology, and strategically placed purchased equipment on campus sites.

2. The consortium sought to involve business and industry in the curriculum plan by offering retraining classes as well as preparatory classes, thus providing financial and in-kind support to existing programs.

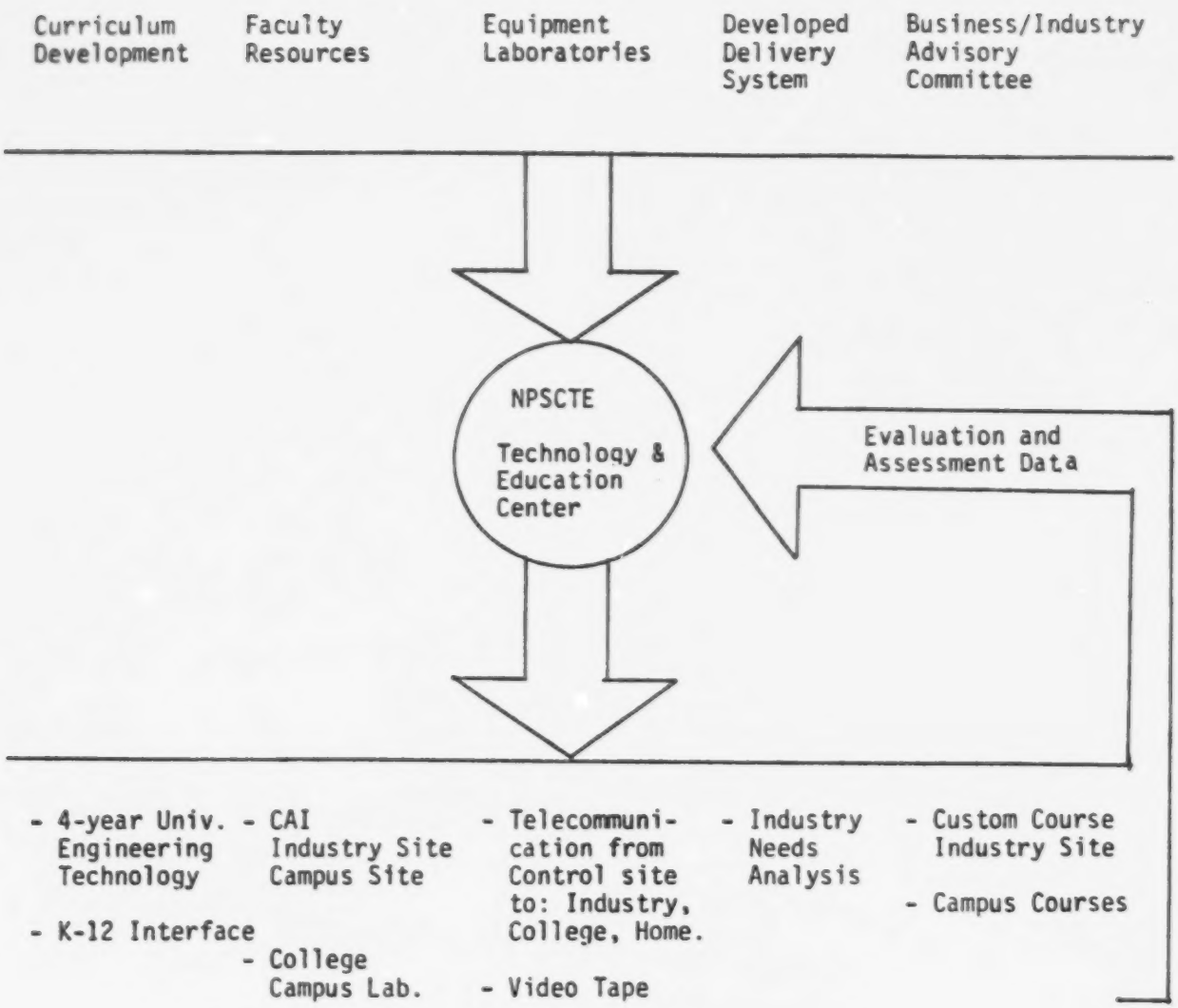
3. The consortium lobbied for outside funding to finance the purchasing of equipment.

Coordination between the campuses was to eventually result in articulated and competency-based curricula and mobile equipment units. The model relied heavily on outside funding; the college programs remained essentially autonomous but linked together by a central coordinating position and a coordinating board made up of the deans of instruction of each campus.

Because of the dependence upon external funding, the consortium dissolved when state funding was discontinued. The constraints of governance and funding patterns were apparent in the implementation of the consortium. Participating colleges had established different funding and program priorities which made continuation of the project difficult. Further, the movement of students between colleges in order to assure access to all instructional programs supported by the model would have meant a loss of FTEs to some campuses.

Figure 1

North Puget Sound Consortium
for Technological Education
Resource Sharing Model



Source: **A Proposed Plan to Complete Technology Resources of the Consortium and Distribute Technology Education Programs to Business, Industry and communities, 1984,** North Puget Sound Consortium for Technological Education.

Further, it was not clear whether district boards, faculty and communities served by the colleges had fully committed to the project.

Summary

The analysis of resource-sharing models focused on looking at models which appeared to have overcome three constraints on successful resource sharing: governance and structure, current funding allocation model, and geographical distribution of programs. The outcomes analyzed were: recognition of existing community college structure, maintenance of FTE distribution, and no impact upon current funding allocation model. Three models were studied: campus exchange, equipment sharing, and college consortium.

The equipment-sharing model would be feasible in the community college system for such programs as: electronics technology, business technology, wood construction, cosmetology, business technology/ data processing, nursing, and other allied health programs. Mobile equipment units would be feasible, especially in areas affected by geographical distance or in areas in which small programs are needed but cannot support necessary equipment expenditures.

The practice of exchanging equipment/lab facilities between campuses would be most feasible in those situations in which competencies existing in programs were transferable or program intent was related. Nevertheless, the application of this model is broad and opportunities are unlimited. Examples of the kinds

of programs for which this model is most feasible were identified as: manufacturing technologies and electronic technologies; allied health technologies; data processing; accounting and office technologies; printing, graphics technology and data processing; drafting technology and engineering technology.

The utilization of the consortium model can be based primarily on the imperative that community colleges must collectively assess their resource needs and must begin to present these needs through group effort to funding sources and to the business community for support. Consortia help to build the political base needed by Washington State community colleges to effectively lobby for renewed or additional financing of technological literacy and technical skills training now required for successful entry into today's job markets. The primary constraint for the consortium model is funding of coordination and administration of the model. As special funding sources disappear, colleges seeking to organize as a consortium must budget in the costs of pooling their resources for collective gain.

SECTION V

SUMMARY OF FINDINGS AND RECOMMENDATIONS

> **The increased significance of technology in our society is not just a fad or a trend. It marks, symbolically and realistically, the end of the industrial period and the beginning of a new era . . . . Postsecondary education's ability to adapt rapidly to the changing dynamics of the marketplace and to fundamental shifts in the economic structure is a major challenge and opportunity of the 1980s.**
> Dr. Harry G. Miller, summer 1984

Summary of Findings

This research project focused on three variables critical to determining future directions for vocational education in Washington State: technological literacy, current and emerging occupations versus training programs in Washington State community colleges, and resource networking among community colleges in the state. Summarily, the project reported the following findings:

First, technological literacy needs in companies using advanced technology were identified as data/information-related competencies, people-related competencies, and equipment competencies. Employees were expected to be able to compute data, synthesize and integrate data to make decisions, and to perform data analyses. Individuals also were expected to listen and follow directions, communicate well verbally and in writing, initiate projects, and negotiate or exchange ideas in a decision-making process. The employees further were expected not only to operate equipment and make it perform the jobs it was designed

for, but were also expected to analyze or evaluate the equipment for purposes of problem identification and maintenance. Finally, in the future, all employees will need to have keyboarding skills necessary to enter data into a computer.

Secondly, Occupational growth in Washington State will be modest through 1990. Labor demand will be primarily in the service industries, especially in marketing and sales, office/clerical and secretarial services, and in culinary-hospitality services. Demand will continue for such occupations as electricians and nurses, but programs currently developed appear to be meeting the level of need. The community college system has at least five traditional programs in which supply exceeds demand by more than 300 percent. These occupations are auto mechanic, welding occupations, electrical and electronic technicians, diesel engine mechanic, and computer programmers/analysts.

Third, community colleges were offering training in only one of the occupations showing the least demand. Overall, the colleges were offering programs in the top twenty occupational clusters, indicating consistency between training offered and occupational demand trends. There was, however, variance between the ranking of occupations in demand and the ranking of level of supply in those occupations. The implications for training in most occupations in demand are for short-term programs and/or programs which teach broad, generalizable skills.

The investigators presented three resource-sharing models

which may be feasible in Washington State, given three criteria: 1) the models could be implemented within the existing community college structure; 2) the balance of FTEs is not disrupted; and 3) there are no negative impacts upon current funding allocation patterns. The models were equipment-sharing, equipment facility exchange, and college consortia. All three models would reduce or contain individual college costs of implementing or expanding needed vocational training programs while increasing and/or maintaining productivity of capital and human resources.

Implications for the Direction of Vocational Education in Washington State Community Colleges

The future of vocational education in community colleges in Washington State depends largely upon the ability of the system to respond creatively to the apparent educational and technological changes now occurring. Administrators and educators alike must accept one salient truism: It is no longer an issue of whether or not change occurs, but when, how, and in which direction.

The concepts presented in the review of literature, in concert with the study project itself, have significant implications for vocational education. First, the data strongly support the need to broaden the basic skills base of vocational curricula so that graduates are equipped to seek employment in a variety of industrial and business settings. This means that

less emphasis should be placed on narrowly defined technical training and more emphasis placed on teaching adaptive skills and in providing a generic knowledge base which can be transferred from one occupation to another. In fact, colleges should move toward teaching skills for employment in occupational clusters rather than designing certificate or degree programs for a single occupation or job title.

Secondly, it is an accepted fact that computers have become basic tools for production of goods and services and for information processing, storage and retrieval. This pervasive role of the computer implies that all vocational education programs need to move toward teaching competencies which result in computer literacy among graduates. The argument can no longer be made that vocational programs which prepare individuals for "no tech," or "low tech," or minimally skilled entry level jobs are appropriately exempt from the inclusion of technological literacy requirements. Technological literacy, as defined in the research report, has become a basic skill requirement of all vocational curricula in Washington state community colleges. Technological literacy further implies a wholistic approach to vocational education which integrates technical and academic instruction.

The data on occupational forecasts of employee demand and supply in Washington State imply that the system has traditional programs in which supply has exceeded demand. To continue large scale training for employment in these occupations would be to

place many graduates at a great disadvantage in the marketplace. The community colleges need to move in the direction of short-term training in high growth/high demand areas. There is also strong indication that programs resulting in entrepreneurial education and occupational retraining need to increase, while preparatory programs need to be carefully matched to the existing and future job markets.

The data imply that business and industry are willing to enter into collaborative agreements with community colleges to provide cooperative educational experiences for students. Inherent in this implication is the fact that hands-on learning experiences need not be confined to on-campus laboratories which attempt to simulate actual job settings. Students can benefit greatly from earlier and more sustained involvement in business and industrial settings as learners.

Finally, the study has implications for the way in which vocational education is delivered in the state's community colleges. As the world of work enters the information age, traditional patterns of teaching occupational skills (lecture/demonstration) must be carefully examined. New methodologies which stimulate critical thinking, which facilitate creativity, and which motivate students to become active and motivated learners must replace methods which rely on rote and imitation.

The labor market is not and will not exist in a steady state--it is dynamic and changing. Anyone with a marketable skill should not assume that the same skill will be viable ten

years from now. In fact, vocational education must look forward to the future and prepare students for jobs not yet named. The need to stay abreast of changes in technology is steadily becoming more urgent. This need presents even greater challenges to education to deliver vocational training which enables individuals to remain competent and productive in the marketplace.

Recommendations

Based on the study results and their implications, the following recommendations for new directions for vocational education in Washington State community colleges are made:

1. Technological literacy should be made a basic exit requirement of graduates of all certificate and degree programs in the community college system. Technological literacy includes competencies in keyboarding and utilization of computers and computer software.

2. Design vocational programs to encourage common core curricula in order to facilitate transfer of students between disciplines and between institutions, with specialization options.

3. Focus on training on occupational clusters so that curriculum content is career specific rather than job specific. Training should be broadened to contain more adaptive skills, teamwork skills, and stress continuation of learning beyond the preparatory period.

4. Expand industry-specific training through cooperative work experience education. Laboratory instruction can then be reduced and resources shifted to more emphasis on integration of basic mathematics, sciences, oral and written communication, and interpersonal concepts into technical courses.

5. Teach personal attribute skills in all curricula, including: pride in work, willingness to work independently, attention to quality in creation of a

product, company loyalty.

6. Basic training should include teaching of job retention skills, job readiness skills, and job promotion skills.

7. Establish state-wide standards for learners of programs which indicate competencies for a particular occupational cluster or career.

8. Institutions should carefully evaluate occupational training programs in which supply is exceeding demand.

9. Approval of new training programs should reflect the shift in occupations to service producing, information processing industries.

10. Vocational education institutions should explore regional planning of curricula to avoid over duplication of programs which result in excessive manpower pools for available jobs.

11. Increase flexibility of curricula to accommodate the needs of working individuals or individuals needing retraining.

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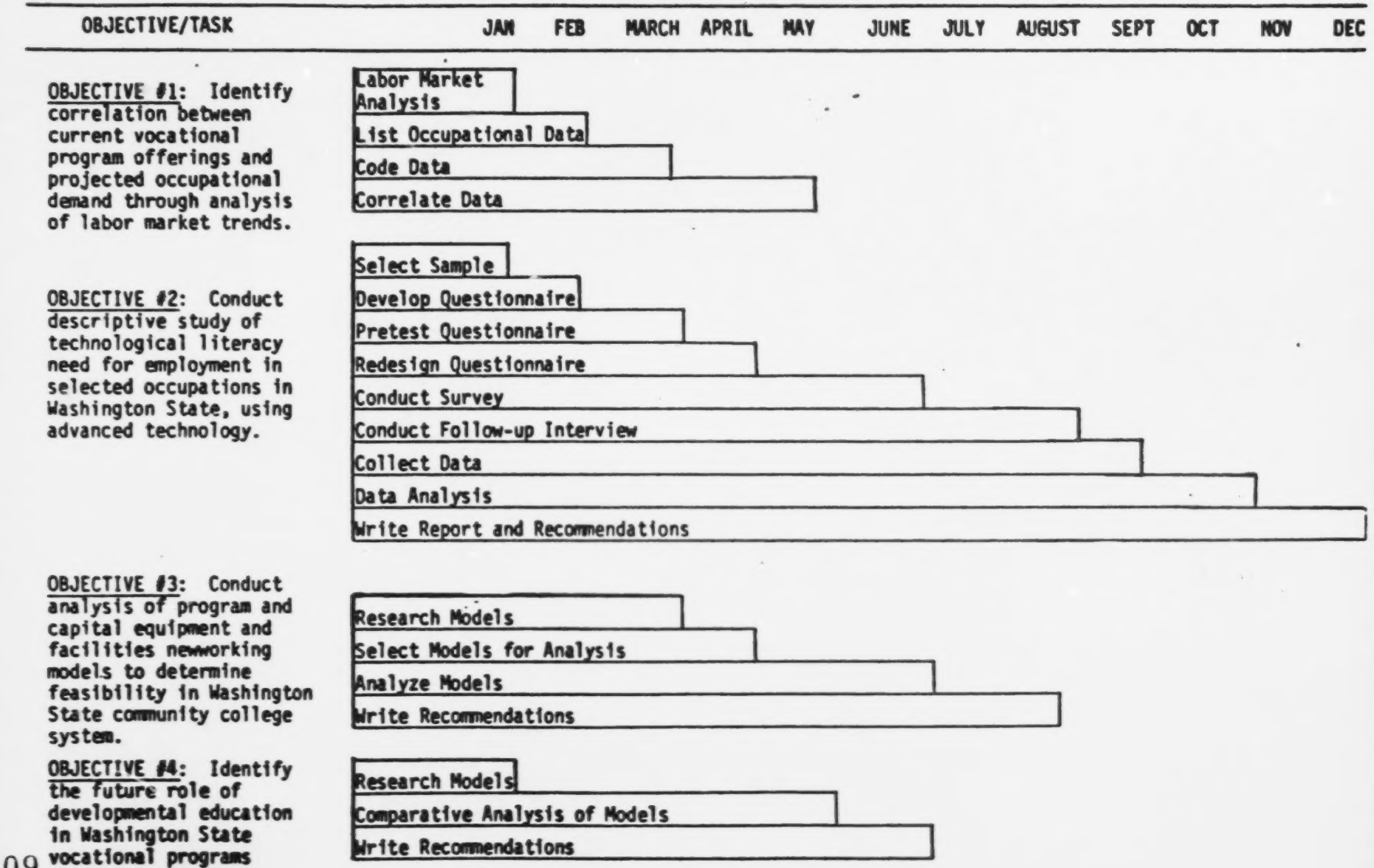
Appendix A

Project Goals

PROJECT MANAGEMENT CHART



Appendix B

Copy of Overview of Occupational Clusters

DEMAND/SUPPLY OVERVIEW BY CLUSTER
SORTED BY TOTAL SUPPLY

CL NO	CLUSTER NAME	GRO	REP	TOTL DEM	% OF DEM	TOTL SUP	% OF SUP	DEM/ SUP
280	MEDICAL.RECORDS.TECHNOLO	113	115	228	0.26	240	0.44	0.95
700	FOREST.PRODUCTION	104	202	306	0.36	239	0.43	1.28
820	HEATING.AIR.CONDITIONING	54	50	104	0.12	219	0.40	0.47
45	MANUFACTURING.TECHNOLOGY	204	218	422	0.49	217	0.39	1.94
535	CLERICAL.OCCUPATIONS	3366	4185	7551	8.76	208	0.38	36.30
635	ANIMAL.SCIENCE	3	5	8	0.01	204	0.37	0.04
20	ARCHITECTURE	51	44	95	0.11	202	0.37	0.47
580	COOKING.&.BAKING.SERVICE	3871	2823	6694	7.77	194	0.35	34.51
260	PHYSICIANS	178	61	239	0.28	193	0.35	1.24
925	DEEP.WATER.DIVING	1	0	1	0.00	185	0.34	0.01
720	MOTOR.VEHICLE.OPERATORS	822	608	1430	1.66	184	0.33	7.77
215	FOREIGN.LANG.SPECIALISTS	0	0	0	0.00	181	0.33	0.00
170	MUSICIANS	38	21	59	0.07	178	0.32	0.33
360	REHABILITATION.SERVICES	143	116	259	0.30	178	0.32	1.46
225	RELIGIOUS.STUDIES	6	9	15	0.02	165	0.30	0.09
975	ELECTRICAL/ELECTRONIC.AS	308	183	491	0.57	159	0.29	3.09
570	HOTEL.&.LODGING.SERVICES	49	73	122	0.14	156	0.28	0.78
420	COUNSELORS	33	33	66	0.08	155	0.28	0.43
730	WATER.TRANSPORTAION.OCCU	239	220	459	0.53	148	0.27	3.10
465	PERSONAL.FASHION.MARKETI	219	376	595	0.69	146	0.27	4.08
350	SPEECH.&.HEARING.TECHNOL	7	6	13	0.02	137	0.25	0.09
865	ELECTRICIANS.&.POWER.TRA	561	327	888	1.03	132	0.24	6.73
600	INSTITUTIONL.&.HOME.SUPP	1036	1940	2976	3.45	129	0.23	23.07
385	PARALEGAL.OCCUPATIONS	44	51	95	0.11	128	0.23	0.74
725	MATERIAL.HANDLING.EQUIPM	515	383	898	1.04	126	0.23	7.13
585	HOME.FURNISHINGS.&.DESIG	10	14	24	0.03	124	0.23	0.19
195	EDITORS.&.REPORTERS	40	31	71	0.08	117	0.21	0.61
670	AGRICULTURAL.BUSINESS.&.	3	5	8	0.01	116	0.21	0.07
880	MISC.CONSTRUCTION.OCCUPA	409	387	796	0.92	116	0.21	6.86
335	PHARMACISTS	60	115	175	0.20	110	0.20	1.59
705	FISH.&.WILDLIFE.MANAGEME	16	27	43	0.05	108	0.20	0.40
345	NUTRITIONAL.SERVICES	51	60	111	0.13	108	0.20	1.03
605	HOME.ECONOMICS.COMSUMER.	0	0	0	0.00	106	0.19	0.00
325	DENTISTS	54	22	76	0.09	102	0.19	0.75
935	PRECISION.WOODWORKERS	146	244	390	0.45	102	0.19	3.82
285	MEDICAL.LABORATORY.TECHN	120	141	261	0.30	101	0.18	2.58
290	RADIOLOGIC.TECHNOLOGY	67	59	126	0.15	100	0.18	1.26
55	SURVEYING.MAPPING.OCCUPA	80	50	130	0.15	100	0.18	1.30
35	ENGINEERING.TECHNOLOGY	73	50	123	0.14	99	0.18	1.24
175	ACTORS.&.DIRECTORS	5	4	9	0.01	96	0.17	0.09
355	RESPIRATORY.THERAPY	23	23	46	0.05	96	0.17	0.48
640	VETERINARIANS	2	2	4	0.00	90	0.16	0.04
860	INTERIOR.FINISHING	241	207	448	0.52	86	0.16	5.21
480	REAL.ESTATE.SERVICES	95	159	254	0.29	86	0.16	2.95
795	MARINE.ENGINE.MECHANICS	26	25	51	0.06	82	0.15	0.62
800	SMALL.ENGINE.REPAIRERS	9	12	21	0.02	79	0.14	0.27
965	PLASTICS	142	123	265	0.31	72	0.13	3.68
870	PLUMBERS.PIPEFITTERS.STE	412	26	638	0.74	71	0.13	8.99

DEMAND/SUPPLY OVERVIEW BY CLUSTER
SORTED BY TOTAL SUPPLY

CL NO	CLUSTER NAME	GRO	REP	TOTL DEM	% OF DEM	TOTL SUP	% OF SUP	DEM/ SUP
560	FIRE.SAFETY	110	74	184	0.21	70	0.13	2.63
180	PAINT.SCULPT.CRAFT-ART.P	0	0	0	0.00	66	0.12	0.00
185	COMMERCIAL.PHOTOGRAPHY	114	105	219	0.25	65	0.12	3.37
460	AUTO.&.REC.VEHICLE.SALES	161	358	519	0.60	64	0.12	8.11
135	URBAL.REGIONAL.PLANNING	31	33	64	0.07	61	0.11	1.05
735	AIRPLANE.PILOTS.&.NAVIGA	33	23	56	0.06	60	0.11	0.93
430	LIBRARIANS	24	44	68	0.08	60	0.11	1.13
650	ANIMAL.CARE.AND.TRAINING	30	27	57	0.07	59	0.11	0.97
815	HOUSEHOLD.APPLIANCE.REPA	39	41	80	0.09	57	0.10	1.40
425	PERSONNEL.&.LABOR.RELATI	200	234	434	0.50	57	0.10	7.61
970	ELECTRICAL.POWER.GENERAT	57	73	130	0.15	55	0.10	2.36
115	ENERGY.CONSERVATION.TECH	0	0	0	0.00	48	0.09	0.00
340	PHARMACY.TECHNOLOGY	22	32	54	0.06	48	0.09	1.12
575	RESTAURANT.SERVICES	3883	2191	6074	7.05	47	0.09	129.23
470	HOUSEHOLD.FURNISHINGS.&.	163	276	439	0.51	44	0.08	9.98
845	BRICK.&.STONE.MASONS	235	116	351	0.41	42	0.08	8.36
645	ANIMAL.TECHNOLOGY	0	0	0	0.00	39	0.07	0.00
825	MISCELLANEOUS.MECHANICS.	31	37	68	0.08	37	0.07	1.84
900	PRECISION.METAL.WORKERS	325	225	550	0.64	36	0.07	15.28
590	UPHOLSTER.LEATHERWORK.&.	54	77	131	0.15	35	0.06	3.74
540	OFFICE.MACHINE.&.COMPUTE	298	144	442	0.51	31	0.06	14.26
680	AGRICULTURAL.MECHANICS	37	34	71	0.08	29	0.05	2.45
435	LIBRARY.ASSISTING	48	68	116	0.13	25	0.05	4.64
565	OCCUPATIONS.SAFETY.&.HEA	74	113	187	0.22	25	0.05	7.48
275	EMERGENCY.MEDICAL.TECHNO	39	31	70	0.08	19	0.03	3.68
685	AGRICULTURAL.PRODUCTS.&.	112	191	303	0.35	18	0.03	16.83
675	AGRICULTURAL.SERVICES.&.	43	62	105	0.12	16	0.03	6.56
950	PRECISION.OPTICAL.WORKER	5	4	9	0.01	16	0.03	0.56
295	TECHNICAL.HEALTH.SERVICE	24	19	43	0.05	16	0.03	2.69
595	DRYCLEANING.&.LAUNDERING	202	282	484	0.56	15	0.03	32.27
740	AIR.TRAFFIC.CONTROL	30	14	44	0.05	14	0.03	3.14
25	ARCHITECTURAL.DESIGN.&.D	148	91	239	0.28	14	0.03	17.07
790	INDUSTRIAL.EQUIPMENT.MEC	194	244	438	0.51	14	0.03	31.29
475	INSURANCE.SALES.OCCUPATI	434	401	835	0.97	14	0.03	59.64
190	DANCERS	10	16	26	0.03	12	0.02	2.17
105	NUCLEAR.TECHNOLOGY	1	1	2	0.00	11	0.02	0.18
855	BOAT.BUILDING	12	11	23	0.03	8	0.01	2.87
315	OPTHALMIC.SERVICES	37	18	55	0.06	8	0.01	6.88
110	ENVIRONMENTAL.TECHNOLOGY	14	41	55	0.06	7	0.01	7.86
200	ADVERTISING.&.PR	147	198	345	0.40	5	0.01	69.00
100	CHEMICAL.TECHNOLOGY	27	36	63	0.07	5	0.01	12.60
885	EXTRACTIVE.OCCUPATION	29	24	53	0.06	5	0.01	10.60
240	ATHLETES.&.RELATED.WORKE	51	25	76	0.09	4	0.01	19.00
410	EDUCATIONAL.ASSISTING	6	9	15	0.02	2	0.00	7.50
95	PHYSICAL.&.BIO.SCIENCE.I	226	147	373	0.43	2	0.00	186.50
875	STRUCTURAL.IRONWORKERS	74	32	106	0.12	1	0.00	106.00
320	CHIROPRACTORS	11	19	30	0.03	0	0.00	0.00
840	CONSTRUCTION.INSPECTION	19	34	53	0.06	0	0.00	0.00

DEMAND/SUPPLY OVERVIEW BY CLUSTER
SORTED BY TOTAL SUPPLY

CL NO	CLUSTER NAME	GRO	REP	TOTL DEM	% OF DEM	TOTL SUP	% OF SUP	DEM/ SUP
810	ELECTRICAL.MOTOR.REPAIRE	14	15	29	0.03	0	0.00	0.00
745	FLIGHT.ATTENDANTS	76	81	157	0.18	0	0.00	0.00
980	FOREST.PRODUCTS.PROCESSI	37	92	129	0.15	0	0.00	0.00
930	FOUNDRY.WORK	45	112	157	0.18	0	0.00	0.00
905	JEWELRY.DESIGN	20	30	50	0.06	0	0.00	0.00
615	MASSAGE	2	4	6	0.01	0	0.00	0.00
620	MORTUARY.SERVICES	12	13	25	0.03	0	0.00	0.00
440	MUSEUM.WORKERS	2	3	5	0.01	0	0.00	0.00
75	OPERATIONS.RESEARCH	0	0	0	0.00	0	0.00	0.00
310	OPTOMETRIST	7	10	17	0.02	0	0.00	0.00
305	PODIATRIST	2	4	6	0.01	0	0.00	0.00
910	SAW.FILING	4	14	18	0.02	0	0.00	0.00
485	SECURITIES.&.COMMODITIES	67	86	153	0.18	0	0.00	0.00
960	SLAUGHTERING.BUTCHERING.	77	171	248	0.29	0	0.00	0.00
160	TECHNICAL.WRITING	1	0	1	0.00	0	0.00	0.00
155	WRITERS	56	54	110	0.13	0	0.00	0.00

END AT LINE 999
>

Appendix C

Pilot Test Procedures

PILOT TEST PROCEDURES

The staff of the Center distributed the draft survey intrument to three (3) personnel directors in the high tech field. A personal interview was scheduled with each and these procedures were followed:

Directions:

We would like you to take a few moments to read the survey and complete it as though you received it in mail. As you are completing this survey, please mark on the survey those aspects you feel need to be changed or that are confusing to you in some way. We will talk about these aspects after you have completed the survey.

After they have completed the survey:

1. check to see if the letter and directions are clear.
2. Problems with Part I??
    a. Was it clear as to what job titles were to be included in this section of the survey?
    b. How many job titles might there be in your company? Did you have problems identifying the top three?
3. Problems with Part II???
    a. Were the directions clear?

b. Was it clear to you that you were to read the definitions prior to completing Part II?

c. Did you have any problems with the definitions?

d. If you were to complete two more sections of Part II, would you probably have to refer back to the definitions again? If yes, for which terms? Are there other terms that are more common with your company that you think would be better - so that you might not have to refer to the definitions again?

e. Do you feel the list of competencies is complete? Are there some basic competencies in Data/Information that you feel should be added and/or changed? (Same questions for the other two competencies areas were asked.)

4. We are planning to mail the survey to the Principal Officer of your company. This person may ask someone, such as yourself to complete it. Do you have any suggestions for revising this intended procedures?

The results of these interviews were used to modify the format, change some of the definitions, and revise some of the terms.

Appendix D

Copy of Mailed Survey Instrument

Appendix E

Copy of Phone Interview Form

STATE COMMUNITY COLLEGE SURVEY
PHONE INTERVIEW FORM

Company name:_____

Contact Person:_____ Phone:_____

No of Employees:_____ Geographic area:_____

Type of Company:___Sales __Service __Manufacturing

Type of Product(s) sold,serviced or manufactured:_____

Introduction: Hello, I am _____ from Gonzaga University and Gonzaga University is conducting a survey for Washington state community college system. The purpose of this survey is to identify the kinds of skills required of persons with associate degrees (or two year community college degrees) who work at companies that use some form of high tech equipment. Would you please take a few moments to answer a few questions over the phone?

(If they say NO, try to get a reason why)

(If they say YES, continue)

1. What kinds of high tech equipment does your company use?

2. Are there any job positions within your company that require a two-year (or associate) degree? ___Yes __No

(If NO, thank them for their time)

3. Approximately how many job positions? _____

4. Approximately how many associate degreed persons does your company currently employ in these positions?_____

5. Do any of these associate degreed postions require the use of high tech equipment? ___Yes __No
If YES -- approximately how many of the associate degreed persons use high tech equipment? _____

others in a decision making process?

_____ b. Instruct or teach others about some aspect of the job?

_____ c. Supervise other workers?

_____ d. Persuade or influence others in favor of a product, service, or point of view?

_____ e. Initiate work projects (i.e. be an independent worker)?

_____ f. Write or exchange information in writting?

_____ g. Speak or talk with others to convey or exchange information?

_____ h. Listen to and follow directions given by others?

_____ i. Particiapte on a team--work with others for the purpose of problem solving?

EQUIPMENT:

Do any of the job positions require that an employee be able to:

_____ a. Create flowcharts that display entire systems--that identify various parts of a system and their interrelatedness?

_____ b. Analyze or evaluate the equipment for the purpose of problem identification?

_____ c. Analyze or evaluate the equipment--or data-- for the purpose of identifying solutions to existing problems?

_____ d. Create programmes for or set up technical, computerized equipment that will permit the equipment to perform specific functions?

_____ e. Operate equipment--start and stop the equipment to make it perform the job it is designed to perform?

_____ f. Maintain the equipment--replace parts of the equipment that need to be replaced based on the diagnostic analysis?

9. What kinds of skills does your company provide on the job training for?

10. How satisfied have you been with the performance of the Associate Degreed persons you have working for your company?

11. What skills do you think the community colleges should emphasize more than they currently are--to make the Associate Degreed persons more effective on the job?

JOB TITLE: ASSOCIATE ENGINEER

JOB SKILLS

DATA: This person must be able to read reports and use information contained in the reports to make decisions. This person makes recommendations to the supervisor regarding his/her review of such information. This person must know about drafting, design, and data collection to be able to make recommendations for modifications. This person may do spot checks on a product and if the product does not meet specifications, this person reports these findings to the supervisor. This person would make the decision as to whether a product passed inspection.

PEOPLE: This person must be able to communicate his/her ideas so that others are willing to listen and follow through. This person would negotiate her/his ideas with the supervisor. **(The lack of people skills is the biggest problem this Company has with its technicians and associate engineers. They have good technical skills, but it is difficult for them to communicate effectively with others. This is the area for which most people would loose their jobs.)**

EQUIPMENT: This person uses test calibration equipment to est for the quality of the product. In addition, this person has responsibility for the operation and daily maintenance of the testing equipment.

COMMENTS: The educational level is an AA in electronics or electrical engineering. Some experience is required. **THE JOB DESCRIPTION FOR THE TECHICIAN AND THE ASSOCIATE ENGINEER ARE THE SAME FOR THIS COMPANY.**

Appendix F

Copy of Personal Visitation Form

Personal Visitation- Interview Questions

The Personnel Supervisor will be interviewed, unless we are directed towards another individual within the company who has knowledge about the responsibilities and functions of various jobs within the company. Information from questions 1-5 on the phone interview form will be obtained prior to the visitation.

1. What are the job titles for those positions within your company for which you hire associate degreed persons?

2. Approximately how many employees are in each position?

<u>For each job position identified:</u>

3. What are the job responsibilities or tasks to be completed in this position?

   Data tasks:

   People tasks:

   Equipment tasks:

4. What skills does an employee in this position need in order to perform adequately?

   Data skills:

   People skills:

   Equipment skills:

5. What skills do you expect the person would have at the time of hiring?

6. What skills do you expect the person would obtain with "on the job training"?

General Questions:

7. What skills do you think the community colleges have been successful in preparing assocaite degreed persons for the job?

8. What skills do you think the community colleges need to include in their curriculum that they are not currently including?

9. What changes in technology do you anticipate will occur in your company in the next five years?

10. Do you expect there to be any changes in your expectations of skills required from associate degreed persons?

11. Does your company currently work with community colleges on a job experience program?

    If YES, what are the arrangements?

Appendix G

Personal Visitation Data - Sample Job Competencies for Specific Positions

JOB TITLE: DATA PROCESSOR

JOB SKILLS

DATA: This person must know the basic entry-level data processing skills. Because of the size of the corporation, this person must be able to operate numerous software programmesand enter data into each one of them. The person must be able to analyze the data entry forms for possible changes.

PEOPLE: This person must be flexible, open to making changes, be self-directed, and work with very limited supervision. The person must be able to understand oral instructions because written manuals are limited. The job demands are high in detail, high level of complexity, multi-use applications, and several computer language knowledge base.

EQUIPMENT: This employee must be able to operate a data-processing computer terminal and use appropriate software.

JOB TITLE: ASSOCIATE SOFTWARE ENGINEER

JOB SKILLS

DATA: This person is required to code, test and debug software packages which have been designed by others from specifications and flowcharts. In addition, this person assists senior personnel in the definition of software tasks and verification of test equipment.

PEOPLE: At the time of hiring, special emphasis is placed on interpersonal skills. The person is expected to be able to participate on a team, read and write common and some technical language, listen carefully to oral communications, participate in an interactive communication process, and negotiate with supervisors. This person does not supervise others.

EQUIPMENT: In this case the equipment will be the software. This person must test, modify, and repair programs based on programme specifications, programme analysis, and/or supervisor's recommendations. Basic knowledge of software and assembler language is required.

COMMENTS: The personnel director emphasized the importance of interpersonal skills and basic communication skills. While the job description indicated a bachelor's degree is required, the current "past practice" has been to hire AA degreed persons.

JOB TITLE: COMPUTER TECHNICIAN

JOB SKILLS

DATA: This person is responsible for writing diagnostic programs used in performing tests using the computer system. This employee performs the basic and routine test inspections. In addition, this person is responsible for testing electronic signs which are produced by the Company before the signs are sold.

PEOPLE: This person must interact with salespersons and representatives who maintain the signs. This employee must be able to communicate the program he/she created (primarily in writing) to the representative who maintains the sign. This person works in an independent fashion and must be able to identify and solve problems within these electronic signs without close supervision.

EQUIPMENT: This person must be able to use the electronic testing equipment of this industry. The testing is usually done by computer analysis. This person is also responsible for maintaining a certain quality in the product before it is put on the market. In a sense, this person is a part of the quality control system of the Company.

COMMENTS: The educational level is an AA in electronics with two years' experience. This person should be well versed in small computers and computers using floppy disk drives.

JOB TITLE: ASSOCIATE SOFTWARE INSTRUCTOR

JOB SKILLS

DATA: This person must have a basic understanding of software programmes, but will learn the company-specific pgrammme products as on-the-job training.

PEOPLE: Since this person assists an instructor in developing instructional training programs for in-house and/or customer, it is essential that the person has a hgh level of proficiency in written and oral communication skills. This person is charged with developing rapport and favorable working relationships in all training situations. On occasions, this person prepares reports and training summaries.

EQUIPMENT: In this position, the equipment is the corporation's software products and the students in the training programs. A basic working knowledge of all software is essential. While the training program is guided by an instructor, this person must function as a team member to facilitate efficient and effective instruction.

COMMENTS: The job description indicates that a person with a BA in computer science, mathematics, or electrical engineering is a minimum qualification. In current practice, persons with AA degrees have been hired for these positions. The personnel director emphasized the need for appropriate interpersonal skills which must be present at the time of hiring.

JOB TITLE: ELECTRONICS DRAFTSPERSON I
JOB SKILLS

DATA: This person learns to help prepare and coordinate documentation packages involving Bills of Materials, Fabrication Drawings, Assembly Drawings, Instructions, Schematics, Interconnection Drawings, and Manuals to support the Company's product line. This person also assists in the preparation and maintenance of documentation records as designed by the Documentation Manager.

PEOPLE: This person must maintain a strong working relationship with all engineering, manufacturing, and purchasing departments to guarantee documentation excellence in the manufacturing process. In addition, this person supports the Documentation Manager by implementing his objective ideas into a working model within the Documentation Department.

EQUIPMENT: This employee must tape printed circuit boards from Engineering schematics and/or sketches, adhering to the Company's design standards.

JOB TITLE: JUNIOR LEVEL DRAFTER

JOB SKILLS

DATA: This person must have the technical skills in drafting. At a minimal level, the person should be competent in lettering and drawing. A knowledge of drafting mathematics is required.

PEOPLE: While it is important for this person to be able to communicate with fellow employees, little emphasis is placed on interpersonal skills. The person must be able to read basic technical directions and listen to directions from immediate supervisor.

EQUIPMENT: This employee must be able to use the traditional drafting tools. An employee at this level in this corporation has very limited use of the CATCAM.

COMMENTS:

JOB TITLE: METHODS ANALYST

JOB SKILLS

DATA: This person analyzes work flow, routing, floor layouts, material handling, and machine utilization. In addition, this person prepares and assists in the coordination of the adoption of resulting recommendations for improved operations. This person must have good spatial relationship skills, mathematical ability and knowledge of flow charting and basic drawing skills.

PEOPLE: Communications, both written and oral, are essential bases for this job.

EQUIPMENT: This person must use a computer and appropriate software in the analysis of data and the development of reports. This employee should be able to draw schematics and use programmes for graphics.

COMMENTS: Methods analysts are assigned to the following departments:

1) Facilities
2) Engineering
3) Customer Support
4) Program Requirements
5) Resource Control

JOB TITLE: ESTIMATOR

JOB SKILLS

DATA: This person must be able to perform tasks such as the calculation of labor/nonlabor costs, targets, budgets, and forecasts based on standard operating procedures. The utilization of computer programming will be a significant part of this job. An understanding of the component parts of cost estimating is critical. Mathematical skills are basic to this job.

PEOPLE: Interpersonal skills are important because information must be obtained from others within the unit. Good communication skills are essential for this job. Basic computational skills are required.

EQUIPMENT: This employee must be able to operate a computer and enter data into the software necessary to make the above calculations.

COMMENTS: The estimator job level is utilized in the following departments and similar job skills are required:

1) Statistics
2) Budget
3) Forecasts
4) Program Planning
5) Production Control
6) Engineering
7) Quality Control
8) Facilities
9) Program Control

JOB TITLE: SCHEDULE PLANNER

JOB SKILLS

DATA: By utilizing standard methods and techniques of scheduling, this person is responsible for performing liaison in facilities and factory organizations on schedule adjustments, processing production and engineering changes in schedule revisions. This person prepares schedules or checks existing schedules on tools, parts, or assemblies. In addition, this employee prepares schedule forms, status forms, and graphic presentations as requested.

PEOPLE: Since it is necessary for this person to contact others, both inside and outside the organization, for the purpose of furnishing and obtaining information, communication skills (written and oral) are essential job skills. Strong interpersonal skills are an integral part of the job.

EQUIPMENT: This person must be able to utilize a computer and the appropriate software essential for scheduling formats.

COMMENTS: The schedule planner is utilized in the following areas:

1) Engineering
2) Facilities
3) Program Planning
4) Fabrication
5) Production Control
6) Spares
7) Master Scheduling
8) Programs
9) Cycle Projection
10) Detail

JOB TITLE: ELECTRONIC COMMUNICATIONS TECHNICIAN

JOB SKILLS

DATA: This person must understand information and communication systems and the electronic components and theories. This employee must be able to analyze problems in the electronic components and do problem-solving related tjo electronic problems by utilizing testing equipment.

PEOPLE: Interpersonal skills are needed but a strong emphasis is placed on writing, reading, and computation skills. This person must be able to read schematics and develop communication components.

EQUIPMENT: This person should be able to use testing equipment and power supplies to operate and test communications electronic components.

JOB TITLE: ELECTRONIC TECHNICIAN

JOB SKILLS

DATA: This person must have a working knowledge of basic electronic technology theory with an understanding of schematic drawings. Some knowledge of digitial theory would be helpful now and in the future.

PEOPLE: A primary concern is the person's interest in this type of work. Because of the detailed aspects of the job, the person's motivation and interest in electronics are important. Interpersonal skills are important because of the team work. This person must be able to read technical manuals.

EQUIPMENT: This employee must understand and have a working knowledge of electronic testing equipment.

JOB TITLE: ELECTRONIC TECHNICIAN I

JOB SKILLS

DATA: This person must prototype and debug circuits, products, and systems as required in the modification and updating of standard products under close supervision. In addition, this person generates documentation packages for submittal to the Test Department Supervisor on prototype and standard products to resolve potential technical problems.

PEOPLE: This person must maintain a strong working relationship with Manufacturing to guarantee test excellence and customer satisfaction of the products in accordance with the Company's workmanship manual. This employee initiates requests for materials, tools, equipment, and other items as required to carry out the objectives of the Department. This person supports the Manufacturing Department Head by implementing his objective ideas into a working model within the Manufacturing Department.

EQUIPMENT: This person aligns, calibrates, and tests electronically all the Company's manufactured products and systems under close supervision. From these tests, the person recognizes and identifies potential problems associated with the manufacturing and testing processes. In addition, this person may create test procedures and design test fixtures for both these processes under close supervision.

COMMENTS: The educational level is an AA in electronics with none to two years of experience working in the electronics industry in testing and repairing equipment.

JOB TITLE: ELECTRONIC TECHNICIAN

JOB SKILLS

DATA: This person uses very limited data and information other than the basic manuals of the Company and read current publications on electronic design.

PEOPLE: This person must be able to communicate orally with customers. This person must be willing to travel frequently and deal with customers on a one-to-one basis. This person must be able to explain the electronic problems to the customer so that in the future the customer may be able to fix it. Because this person is a field representative of the Company in a time of a problem, this person's personality must be pleasant at all times.

EQUIPMENT: This person must be able to repair and test electronic equipment (signs) to the chip level (very intricate). This person must be able to analyze the problem and provide a solution through the use of electronic testing equipment.

COMMENTS: The educational level is an AA in electronics with some on-the-job training.

JOB TITLE: TECHNICIAN

JOB SKILLS

DATA: This person has to read blueprints which are constantly changing. From change orders on blueprints, this person makes modifications in the work orders and maintains records on the various production machines. This technician is responsible for the manufacturing of the entire products at his/her workbench, therefore quality control based on blueprint reading is essential.

PEOPLE: In this Company, everyone works together. This person must be a part of a team (prior used Quality Circles). Each person is important to the team because each knows the equipment and helps to solve problems. This person must have a high level of communication skills, both written and oral.

EQUIPMENT: This person assembles the instrument based on blueprints. This person does NOT computer programme. If a design change must be made, this person contacts the engineer for that unit.

COMMENTS: The educational level is an AA in technical equipment and some job experience.

JOB TITLE: **ELECTRONIC TECHNICIAN**

JOB SKILLS

DATA: This person must be able to read reports and use information contained in the reports to make decisions. This person makes recommendations to the supervisor regarding his/her review of such information. This person must know about drafting, design, and data collection to be able to make recommendations for modifications. This person may do spot checks on a product and if the product does not meet specifications, this person reports these findings to the supervisor. This person would make the decision as to whether a product passed inspection.

PEOPLE: This person must be able to communicate his/her ideas so that others are willing to listen and follow through. This person would negotiate her/his ideas with the supervisor. **(The lack of people skills is the biggest problem this Company has with its technicians and associate engineers. They have good technical skills, but it is difficult for them to communicate effectively with others. This is the area for which most people would loose their jobs.)**

EQUIPMENT: This person uses test calibration equipment to est for the quality of the product. In addition, this person has responsibility for the operation and daily maintenance of the testing equipment.

COMMENTS: The educational level is an AA in electronics or electrical engineering. Some experience is required. **THE JOB DESCRIPTION FOR THE TECHICIAN AND THE ASSOCIATE ENGINEER ARE THE SAME FOR THIS COMPANY.**

JOB TITLE: ENGINEERING TECHNICIAN I

JOB SKILLS

DATA: This person tests components of computer engineering projects as well as assemblies and sub-assemblies of these projects. The person writes reports, develops charts and graphs, and gathers statistical data as requested.

PEOPLE: At the time of hiring as well as during employment, special emphasis is placed on the ability of this person to communicate in written and oral form. A moderate level of common and technical language is needed. As this person interfaces with others in the Engineering Department, the need for appropriate interpersonal skills is imperative for normal operations.

EQUIPMENT: In this position, the equipment includes the main product of the cooperation, computers. Additional equipment such as testing meters is used to analyze and test for component problems. This person must breadboard, assemble, and test electrical circuits by using various techniques as wire wrapping, soldering, and cabling to ensure a product of specified standards. In the daily operation of this equipment, this person must perform routine maintenance on the various laboratory systems.

COMMENTS: Even though an AA degree in electronic technology is stated as the minimum qualifications, the current "past practice" is to promote from other entry level positions based on aptitude and work experience. The personnel director did state that persons promoted to this position are encouraged to earn an AA degree.